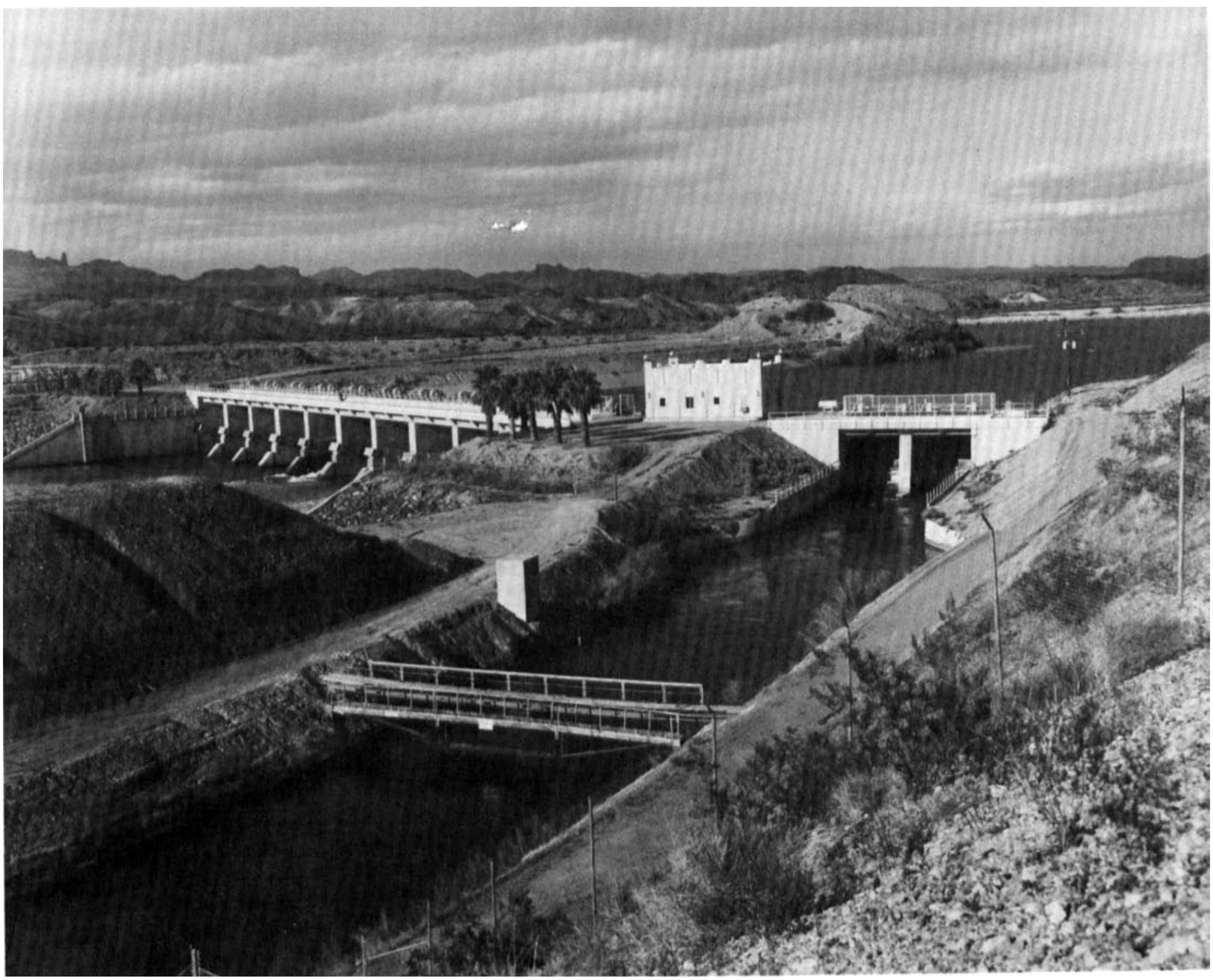
United States
Department of
Agriculture

Soil
Conservation
Service

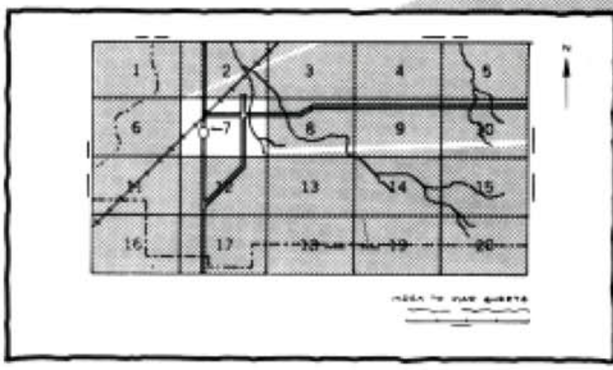
In cooperation with
United States Department
of the Interior, Bureau
of Indian Affairs; Arizona
Agricultural Experiment Station;
and
California Agricultural
Experiment Station

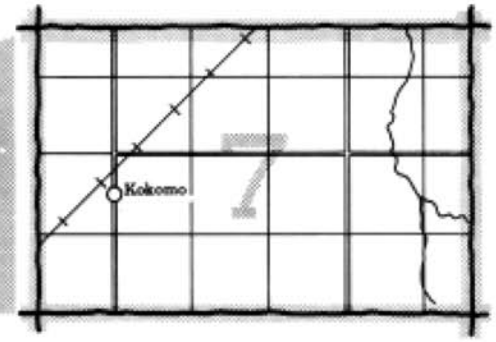
Soil Survey of Colorado River Indian Reservation Arizona—California



HOW TO USE

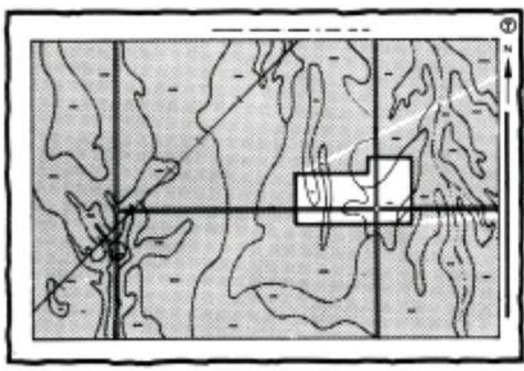
1. Locate your area of interest on the "Index to Map Sheets"

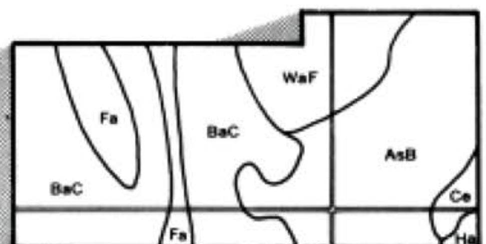




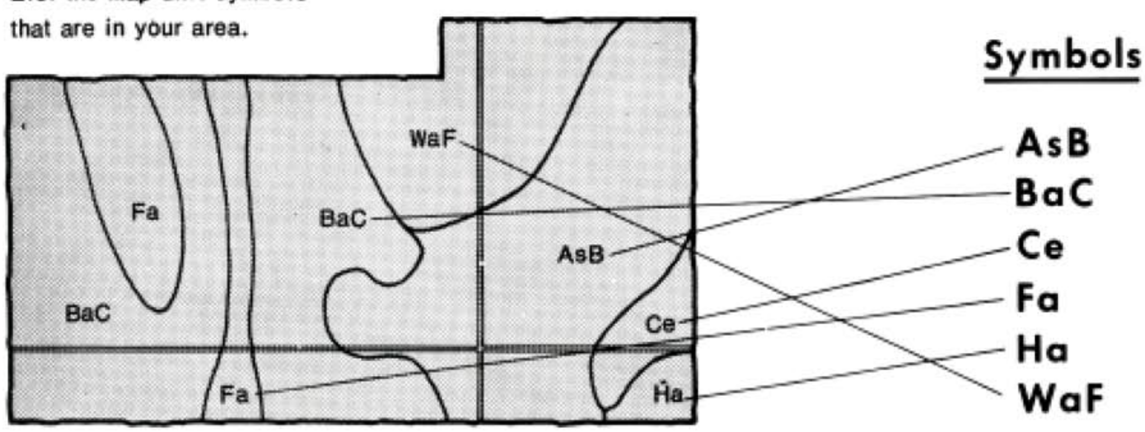
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



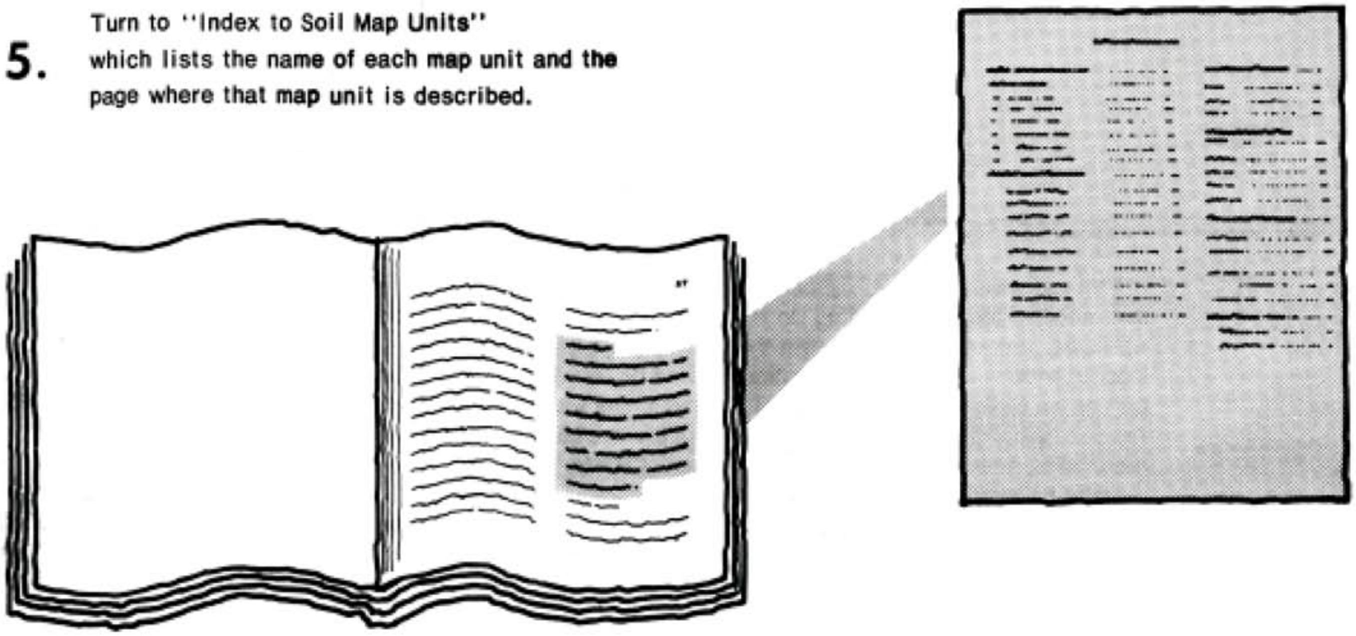


4. List the map unit symbols that are in your area.

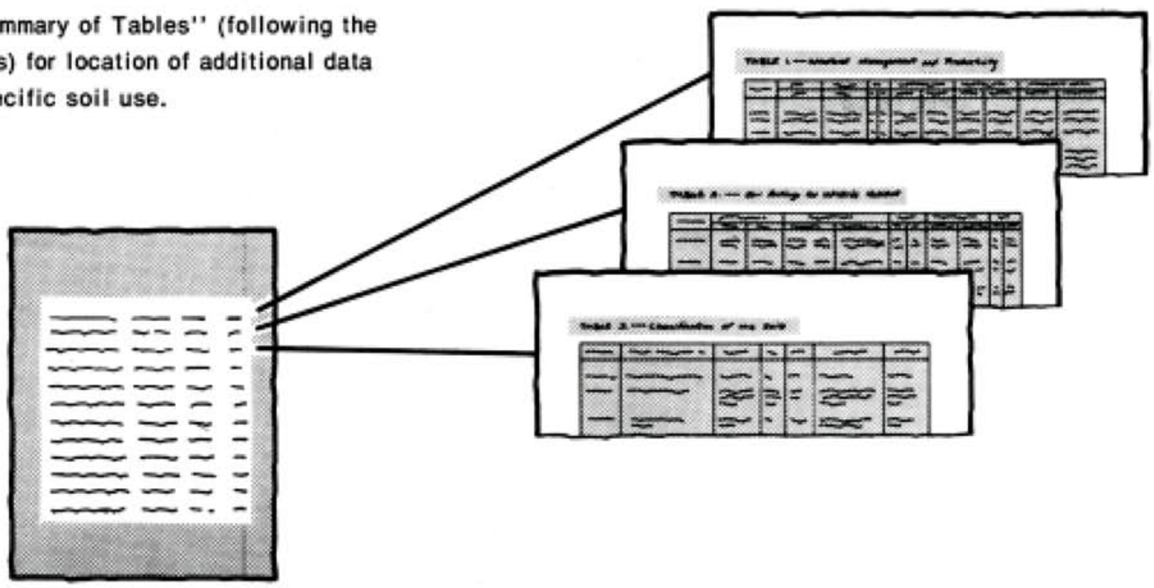


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Indian Affairs, the Arizona Agricultural Experiment Station, and the California Agricultural Experiment Station. It is part of the technical assistance furnished to the Parker Valley Natural Resource Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover Headgate Rock Dam water diverted from the Colorado River to be used on the cropland of the Colorado River Indian Reservation.

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Soil Series

Issued November 1986

Index to Map Units

Summary of Tables

Foreword

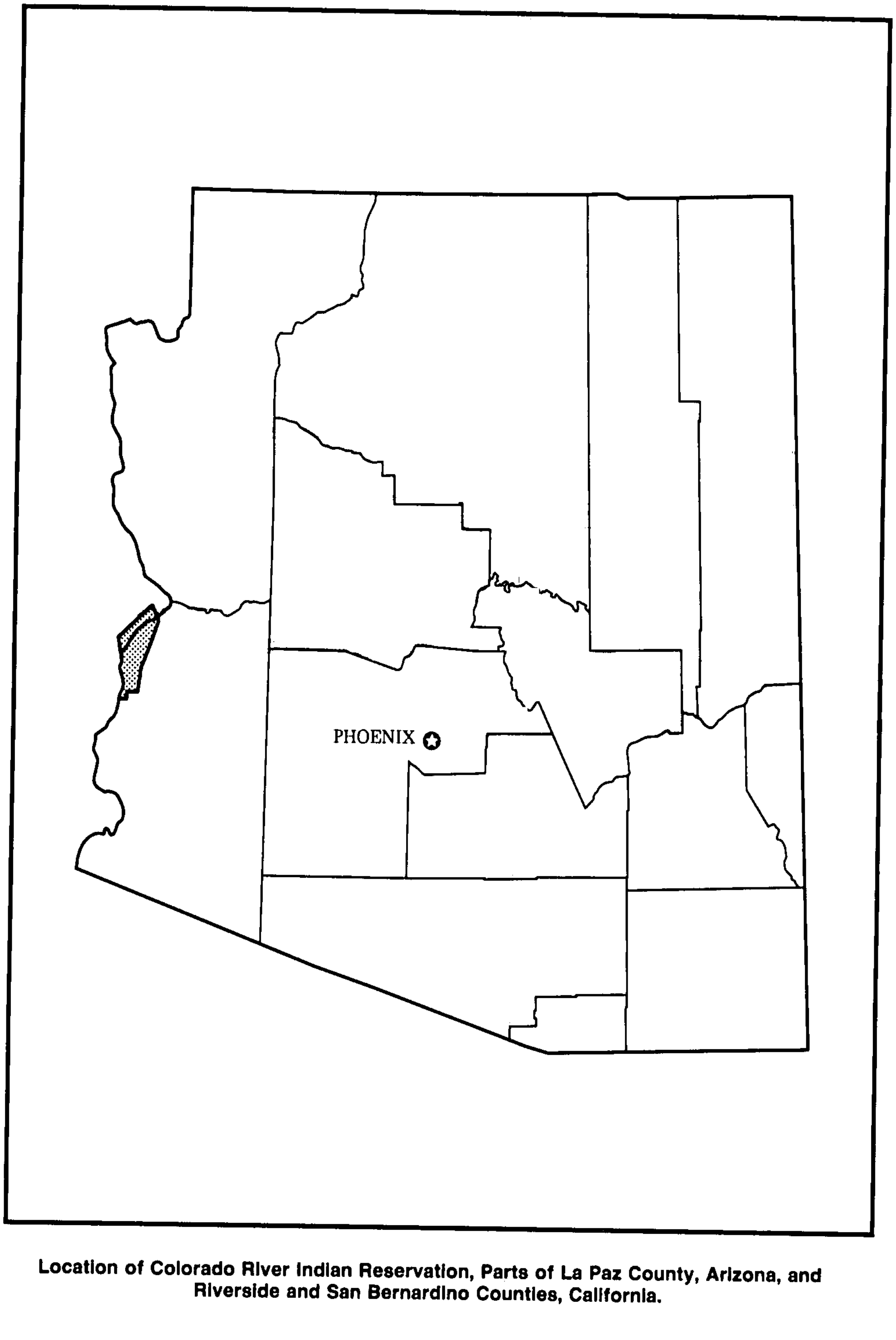
This soil survey contains information that can be used in land-planning programs in the Colorado River Indian Reservation. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Verne M. Bathurst
State Conservationist
Soil Conservation Service



Location of Colorado River Indian Reservation, Parts of La Paz County, Arizona, and Riverside and San Bernardino Counties, California.

Soil Survey of Colorado River Indian Reservation Arizona—California

By Frank L. Nelson, Soil Conservation Service

Fieldwork by Frank L. Nelson and Edward R. Fenn, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
United States Department of the Interior, Bureau of Indian Affairs; Arizona Agricultural Experiment Station; and California Agricultural Experiment Station

COLORADO RIVER INDIAN RESERVATION is in the southwestern part of Arizona and the southeastern part of California. It consists of parts of La Paz County, Arizona, and Riverside and San Bernardino Counties, California. The reservation was established on March 3, 1965. It has a total area of 268,850 acres, or 420 square miles. Parker, Arizona, the largest town in the survey area, has a population of 3,100, and Parker Valley has a population of about 9,800. Other communities on the reservation include Big River, California, and Poston, Arizona. About 2,600 Indians of the Mohave, Chemehuevi, Navajo, and Hopi tribes live on homesites scattered throughout the reservation.

The survey area is in the Western Range and Irrigated Region of the Sonoran Desert section of the Basin and Range province. The boundaries follow irregular lines. The Colorado River flows through the survey area. Elevation ranges from 250 feet where the Colorado River flows out of the area to 2,500 feet on some of the peaks scattered throughout the area.

The climate in the survey area is characterized by moderate weather in winter and by hot, dry weather in summer. Precipitation is sporadic. It occurs mainly in July to September and December to February.

Farming is the most important economic enterprise in the survey area. The main crops are cotton, alfalfa, lettuce, melons, grain sorghum, wheat, and onions. Additional income is provided by tourism.

About 99 percent of the farmland is on the flood plain of the Colorado River, where there is access to gravity-fed water from Headgate Rock Dam. The other 1 percent, or about 1,585 acres, is above the flood plain escarpment and on adjacent terraces and is irrigated by water from wells.

Arizona Highway 72 and California Highway 62 cross the northern part of the reservation, U.S. Highway 95 generally parallels the western side, and a good blacktop road called "Mohave Road" traverses the middle of Parker Valley from north to south. A railroad crosses the northern and eastern parts of the reservation. Parker is served by a busline and an airport, which handles local air traffic. Most of the major crossroads in the valley have been blacktopped, and a bridge that connects Mohave Road with U.S. Highway 95 has been rebuilt across the Colorado River.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps fo adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Summers in this survey area are long and very hot. Winters are quite warm despite an occasional series of days when the temperature at night drops below freezing. Rainfall is scant in all months.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Parker, Arizona, for the period 1951-80. Table 2 shows probable dates of the last freeze in spring and the first freeze in fall. Table 3 provides data on length of the growing season.

In winter, the average temperature is 55 degrees F and the average daily minimum temperature is 40 degrees. The lowest temperature on record, which occurred at Parker on January 3, 1970, is 17 degrees. In summer, the average temperature is 92 degrees and the average daily maximum temperature is 107 degrees. The highest recorded temperature, which occurred on June 25, 1970, is 121 degrees.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 1 inch, or 25 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 1 inch. The heaviest 1-day rainfall during the period of record was 2.1 inches at Parker on October 21, 1978. Thunderstorms occur on about 23 days each year, and most occur late in summer.

Snowfall is rare; in 99 percent of the winters, there is no measureable snowfall. In 1 percent, there is only a trace of snowfall, usually of short duration.

The average relative humidity in midafternoon is about 25 percent. Humidity is higher at night, and the average at dawn is about 40 percent. The sun shines 85 percent of the time possible in summer and 75 percent in winter. The prevailing wind is from the east. Average windspeed is highest, 6 miles per hour, in summer.

Strong, dry, dusty winds with gusts of as much as 75 miles per hour occur at times in summer and winter.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually onto one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of

the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Map Unit Descriptions

1. Gilman-Glenbar-Lagunita

Deep, well drained and somewhat excessively drained, level to undulating, loamy and sandy soils; on flood plains

This map unit is on the Colorado River flood plain. It is in Paloverde Valley, California, and Parker Valley, Arizona. Slopes range from 0 to 5 percent.

This unit makes up about 52 percent of the survey area. About 22 percent of the unit is Gilman and similar soils, 22 percent is Glenbar and similar soils, 12 percent is Lagunita and similar soils, and 44 percent is soils of minor extent.

The soils in this unit have thin strata of contrasting textures throughout. The well drained Gilman soils are stratified very fine sandy loam, silt loam, or loam; the well drained Glenbar soils are stratified clay loam, silty clay loam, or silt loam; and the somewhat excessively drained Lagunita soils are sandy throughout.

Of minor extent in this unit are well drained Agualt, Cibola, Gadsden, Kofa, Meloland, Ripley, and Vint soils.

This unit is used mainly for irrigated cotton, alfalfa, lettuce, cantaloupe, wheat, grain sorghum, and onions. The town of Poston is in this unit. In addition, an increasing number of individual homes are being built on it. Some areas are still in native vegetation.

The hazard of flooding limits the use of this unit for homesite development. Some areas of this unit are limited for sanitary facilities and homesites because of the moderately slow permeability and moderate shrink-swell potential of the underlying layer. Some of the soils in this unit are limited for sanitary facilities because of poor filtering qualities. Although the unit is temporarily protected, the hazard of flooding still exists.

2. Carrizo

Deep, excessively drained, nearly level to gently sloping, very gravelly and sandy soils; on flood plains

This map unit is on flood plains of Parker Valley. The valley drains to the Colorado River. Slopes range from 0 to 3 percent.

This unit makes up about 4 percent of the survey area. It is about 78 percent Carrizo and similar soils and 22 percent soils of minor extent.

The soils in this unit are stratified very gravelly sand throughout.

Of minor extent in this unit are well drained Antho, Chuckawalla, and Gunsight soils and somewhat excessively drained Lagunita soils.

This unit is used as rangeland.

This unit is limited for homesites and septic tank absorption fields because of the hazard of flooding.

3. Superstition-Rositas

Deep, somewhat excessively drained, nearly level to rolling, sandy soils; on stream terraces and sand dunes

This map unit is on the Cactus Plain, adjacent to the Colorado River flood plain. Slopes range from 0 to 15 percent.

This unit makes up about 18 percent of the survey area. About 56 percent of this unit is Superstition and similar soils, 29 percent is Rositas and similar soils, and 15 percent is soils of minor extent.

The Superstition soils are nearly level, are on stream terraces, and occupy interdune areas. The Rositas soils

are undulating and are on dunes. The vegetation is white bursage and creosotebush on the Superstition soils and big galleta and primrose on the Rositas soils. Both soils are sandy throughout, but the Superstition soils have an accumulation of lime below a depth of about 12 inches.

Of minor extent in this unit are well drained Chuckawalla and Gunsight soils and excessively drained Carrizo soils. The Chuckawalla soils are on nearly level summits of fan terraces, the Gunsight soils are on the sides of fan terraces, and the Carrizo soils are on flood plains.

This unit is used mainly as rangeland, but a part of the Cactus Plain is used for irrigated alfalfa.

The soils in this unit have severe limitations for most kinds of sanitary facilities and for water development.

4. Gunsight-Chuckawalla

Deep, well drained, nearly level to very steep, very gravelly and extremely gravelly, loamy soils; on fan terraces and hillslopes

This map unit is on broad dissected fan terraces and hillslopes adjacent to Parker Valley. Slopes range from 1 to 60 percent.

This unit makes up about 10 percent of the survey area. About 63 percent of the unit is Gunsight and similar soils, 19 percent is Chuckawalla and similar soils, and 18 percent is soils of minor extent.

The Gunsight soils are on hillslopes and sides of fan terraces. The Chuckawalla soils are on the nearly level to gently sloping summits of fan terraces. Both soils are very gravelly and extremely gravelly throughout. The Chuckawalla soils have a desert pavement over strongly saline soil material.

Of minor extent in this unit are well drained Antho soils, excessively drained Carrizo soils, and somewhat excessively drained Rositas and Superstition soils.

The soils of this unit are used as rangeland. Some areas are used as homesites.

The main limitations for farming are the high content of toxic salts in the Chuckawalla soils, the high gravel content, and the steepness of slope. The main limitations for septic tank absorption fields and homesite development are the slow permeability in the upper part of the Chuckawalla soils and the high gravel content.

5. Laposa-Rock outcrop-Cherioni

Moderately deep, very shallow, and shallow, well drained, moderately steep to very steep, extremely gravelly, loamy soils, and Rock outcrop; mainly on hillslopes

This map unit makes up about 8 percent of the survey area. About 47 percent of the unit is Laposa and similar soils, 25 percent is Rock outcrop, 13 percent is Cherioni and similar soils, and 15 percent is soils of minor extent.

The Laposa soils are underlain by bedrock at a depth of 20 to 35 inches. They are extremely gravelly sandy loam and are on moderately steep to very steep hillslopes. Rock outcrop consists of exposures of granitic and volcanic rock on the peaks and crests of the hills and mountains. The Cherioni soils have a silica- and lime-cemented hardpan and bedrock within 20 inches of the surface. They are on hilly to very steep hillslopes.

Of minor extent in this unit are well drained Chuckawalla and Gunsight soils and excessively drained Carrizo soils.

This unit is used as rangeland.

This unit is poorly suited to crops, sanitary facilities, and homesite development. Steepness of slope and the depth to bedrock are the main limitations for these uses.

6. Badland-Torriorthents-Torripsamments

Very shallow to deep, well drained and somewhat excessively drained, moderately steep to very steep soils; on hillslopes

This map unit is on the dissected, eroded parts of uplands throughout the survey area. Slopes range from 10 to 60 percent.

This unit makes up about 8 percent of the survey area. About 35 percent of the unit is Badland, 30 percent is Torriorthents, 20 percent is Torripsamments, and 15 percent is soils of minor extent.

Badland is mainly areas of exposed sandstone, siltstone, and claystone. Torriorthents are highly variable in texture. They range from sand to clay and are 10 to 80 percent rock fragments. They are on summits and back slopes of hills. Torripsamments are deep, are sand and loamy sand, and are on the toe slopes and foot slopes of hills.

Of minor extent in this unit are somewhat excessively drained Rositas and Superstition soils on summits of ridges and toe slopes of hills and excessively drained Carrizo soils in drainageways.

This unit has very limited use as rangeland.

This unit is severely limited for farming, homesite development, and septic tank absorption fields because of the slope and variability in texture and depth.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation to precisely define and locate the soils and miscellaneous areas is needed.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Gilman fine sandy loam, 0 to 1 percent slopes, is one of several phases in the Gilman series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or associations.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Agualt-Cibola sandy loams, 0 to 1 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary

to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Superstition-Rositas association, 0 to 15 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

1—Agualt-Cibola sandy loams, 0 to 1 percent slopes. This map unit is on flood plains. Elevation is 250 to 400 feet.

This unit is 55 percent Agualt sandy loam and 30 percent Cibola sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small area of Gilman, Glenbar, Lagunita, Ripley, and Vint soils. Also included are small areas of soils that are strongly saline. These included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The deep, well drained Agualt soil is on flood plains. It formed in stratified mixed alluvium. Typically, the surface layer is light yellowish brown sandy loam about 9 inches thick. The next layer is pale brown very fine sandy loam and light brown loam about 19 inches thick. Below this to a depth of 60 inches or more is pink sand that has thin strata of silt 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 60 inches.

Permeability of the Agualt soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

The deep, well drained Cibola soil is on flood plains. It formed in stratified mixed alluvium. Typically, the surface layer is pale brown sandy loam about 10 inches thick. The upper 25 inches of the underlying material is stratified, light yellowish brown, light brown, brown, and very pale brown silty clay loam, silt loam, and loam that have thin strata of sand. Below this to a depth of 60 inches or more is pink fine sand that has thin strata of silt 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 30 inches.

Permeability of the Cibola soil is moderately slow to a depth of 35 inches and rapid below this depth. Available water capacity is moderate. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly alfalfa, cotton, lettuce, cantaloupe, wheat, grain sorghum, and onions.

This unit is suited to irrigated crops. It is limited mainly by the depth to sand, moderate available water capacity, and content of toxic salts in some areas. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. If the land is leveled for irrigation, cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seed for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinkler irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Irrigation water should be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Subsoiling temporarily improves water infiltration and allows salts to be leached downward. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, and increases the available water capacity. Crop residue should be incorporated into soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Soil blowing can also be reduced by returning crop residue to the soil and practicing minimum tillage.

This map unit is in capability subclasses IIs, irrigated, and VIIs, nonirrigated.

2—Agualt-Cibola sandy loams, strongly saline, 0 to 3 percent slopes. This map unit is on flood plains. The vegetation in areas not cultivated is mainly mesquite,

saltcedar, arrowweed, and saltbush. Elevation is 250 to 400 feet.

This unit is 45 percent Agualt sandy loam and 40 percent Cibola sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Gilman, Glenbar, Kofa, Lagunita, Ripley, and Vint soils. These included soils make up about 15 percent of the total acreage.

The deep, well drained Agualt soil is on flood plains. It formed in stratified mixed alluvium. Typically, the surface layer is brown, strongly saline sandy loam about 3 inches thick. The upper 25 inches of the underlying material is light yellowish brown, strongly saline very fine sandy loam, and the lower part to a depth of 60 inches or more is very pale brown, strongly saline sand. Thin strata of sand and silt 0.5 inch thick or more are common below the surface layer, and a few reddish brown mottles are below a depth of about 30 inches in some pedons.

Permeability of this Agualt soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is very low because of the excessive amount of salts in the soil. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

The deep, well drained Cibola soil is on flood plains. It formed in mixed alluvium. Typically, the surface layer is light yellowish brown, strongly saline sandy loam about 7 inches thick. The upper 25 inches of the underlying material is stratified, brown, pale brown, light brown, and light yellowish brown, strongly saline silty clay loam, silt loam, and loam. The lower part to a depth of 60 inches or more is pink fine sand that has thin strata of silt 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of 30 inches.

Permeability of this Cibola soil is moderately slow to a depth of 35 inches and rapid below this depth. Available water capacity is very low because of the excessive amount of salts in the soil. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used mainly as rangeland. Some areas are used for homesite development. The unit can be used for irrigated crops if the land is leveled, water is made available, and toxic salts are removed. The unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential natural plant community on this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the soil dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending to a depth of 20 to 30 feet. Because this unit is on flood plains, the water table often is at this depth. The soil therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitations are the very low available water capacity, depth to sand, and the content of toxic salts. An intensive onsite investigation is desirable if land leveling cuts are to be made. If the land is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material. Salinity influences the choice of crops. Reclaiming and improving the soil in this unit involves several years of leaching and growing a salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil tilth enough to grow other adapted crops that provide good yields. Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition.

This unit is poorly suited to homesite development. The main limitation is the hazard of flooding.

If this unit is used for septic tank absorption fields, the main limitation is the hazard of ground water contamination because of seepage.

This map unit is in capability subclasses VIIs, nonirrigated, and IVs, irrigated. It is in the Saline Bottom, 2- to 7-inch p.z., range site.

3—Antho loamy fine sand, 0 to 3 percent slopes. This deep, well drained soil is on flood plains and alluvial fans. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly mesquite, ironwood, saltcedar, arrowweed, and bursage. Elevation is 250 to 400 feet.

Typically, the surface layer is very pale brown loamy fine sand 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown and light yellowish brown, moderately alkaline sandy loam that has strata of sand, gravelly loamy sand, and silt 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 30 inches.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small areas of Agualt, Carrizo, Gilman, Glenbar, and Vint soils. Also included are small areas of soils that are saline and soils that have a surface layer of sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Antho soil is moderately rapid. Available water capacity is moderate. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used mainly as rangeland. Some areas are used for homesite development. The unit can be used for irrigated crops if the land is leveled and water is made available. This unit is moderately suited to desertic trees and shrubs and poorly suited to desertic herbaceous plants that provide habitat for wildlife.

The potential natural plant community on this Antho soil is dominantly creosotebush, white bursage, big galleta, bush muhly, and white ratany.

This unit is moderately suited to irrigated crops. The main limitation is slope. An intensive onsite investigation is needed if land leveling cuts are to be made. Basin, furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition.

This unit is poorly suited to homesite development. The main limitation is the hazard of flooding.

If this unit is used for septic tank absorption fields, the main limitations are the potential for ground water contamination and the hazard of flooding.

This map unit is in capability subclasses IIIs, irrigated, and VIIs, nonirrigated. It is in the Limy Fan, 2- to 7-inch p.z., range site.

4—Badland-Torriorthents-Torripsamments complex, 10 to 60 percent slopes. This map unit is on hillslopes. The native vegetation is mainly big galleta, creosotebush, and white bursage (fig. 1). Elevation is 400 to 1,000 feet.

This unit is 35 percent Badland, 30 percent Torriorthents, and 20 percent Torripsamments. Badland is on hilly to very steep shoulders of back slopes, Torriorthents are on hilly to steep summits and back slopes, and Torripsamments are on rolling to hilly toe slopes and foot slopes of hills. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Carrizo, Cherioni, Chuckawalla, Gunsight, Laposa, and Superstition soils. Also included are small areas of gravelly soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Badland consists mainly of exposed areas of sandstone, siltstone, and claystone. In some areas the surface is gravelly. Runoff is rapid.

Torriorthents formed in unconsolidated alluvial sediment derived dominantly from claystone, siltstone, sandstone, and mixed pebbles. These soils are highly variable in texture. They range from sand to clay. These soils are 10 to 80 percent rock fragments.

Permeability of these soils is variable. Potential rooting depth is 30 to 60 inches or more. Available water capacity is low. Runoff is rapid, and the hazard of water erosion is high.

Torripsamments formed in unconsolidated alluvial sediment derived dominantly from claystone, siltstone, sandstone, and mixed pebbles. Texture is fine sand or loamy sand. Potential rooting depth is 60 inches or more. Available water capacity is very low. Runoff is slow, and the hazard of wind erosion is very high.

This unit is used as rangeland. It is very poorly suited to desertic herbaceous plants, shrubs, and trees that provide habitat for wildlife.

The potential plant community on this unit is dominantly a sparse cover of creosotebush and some big galleta and primrose.

This unit is not suited to cultivated crops.

This map unit is in capability subclass VIIe. Badland is not placed in a range site. The Torriorthents are in the Limy Upland, 2- to 7-inch p.z., range site, and the Torripsamments are in the Sandy Upland, 2- to 7-inch p.z., range site.

5—Carrizo extremely gravelly coarse sand, 0 to 3 percent slopes. This deep, excessively drained soil is on flood plains and alluvial fans. It formed in mixed alluvium. The vegetation is mainly creosotebush, paloverde, ironwood, big galleta, and mesquite (fig. 2). Elevation is 250 to 400 feet.

Typically, the surface layer is light grayish brown extremely gravelly coarse sand 5 inches thick. The underlying material to a depth of 60 inches or more is light grayish brown, light yellowish brown, brown, and grayish brown very gravelly coarse sand and very gravelly loamy coarse sand that has thin strata of fine sandy loam and sandy loam 0.5 inch thick or more.

Included in this unit are small areas of Antho, Chuckawalla, Gunsight, Laposa, Rositas, and Superstition soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Carrizo soil is very rapid. Available water capacity is very low. Potential rooting depth is 60 inches or more. Runoff is slow. This soil is subject to occasional, very brief periods of flooding nearly anytime during the year, but primarily in June through October.

This unit is used as rangeland. It is moderately suited to desertic riparian herbaceous plants and desertic riparian trees, shrubs, and vines that provide habitat for wildlife.

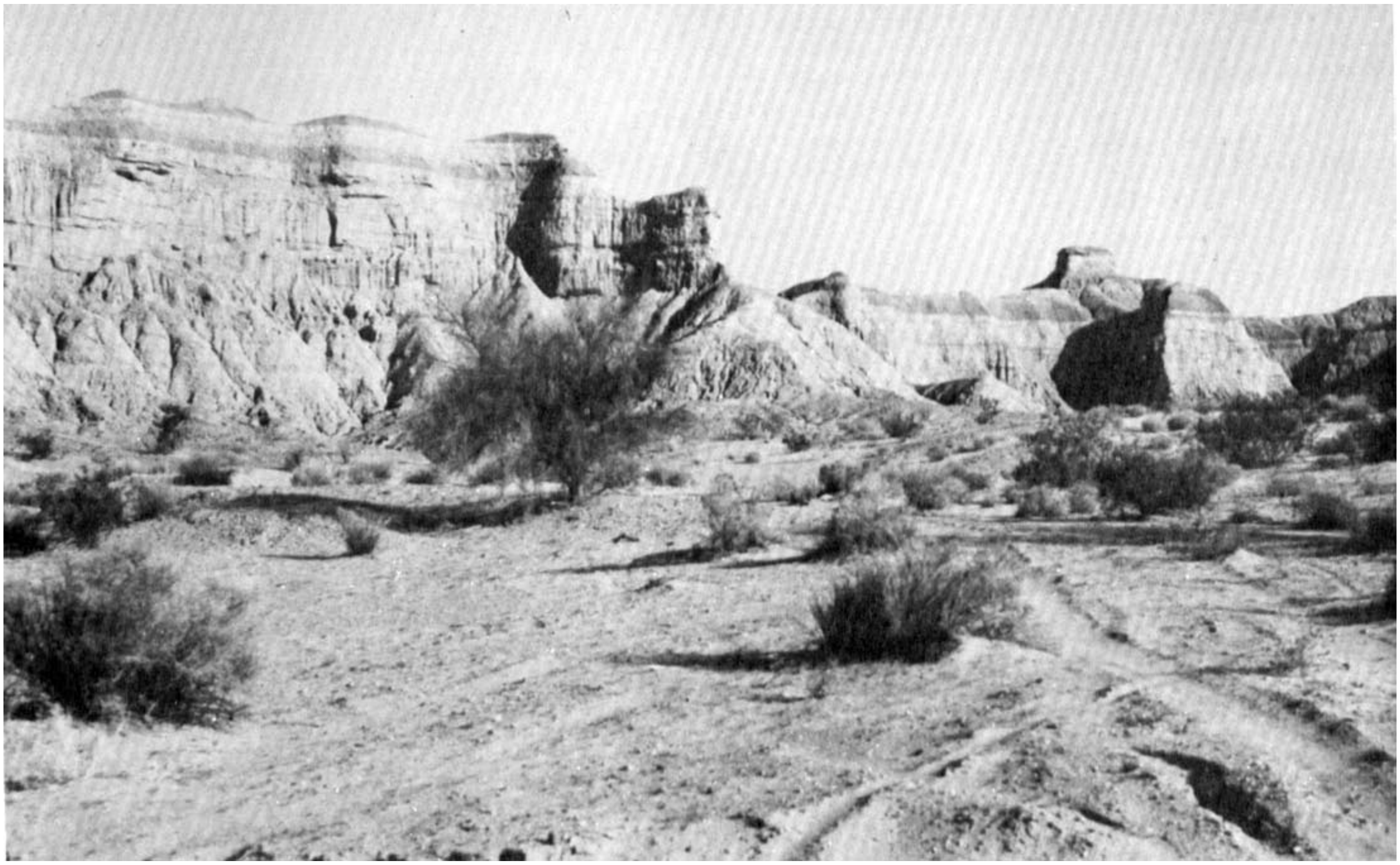


Figure 1.—Typical area of Badland-Torriorthents-Torripsamments complex, 10 to 60 percent slopes.

The potential plant community on this unit is dominantly desert ironwood, desertthorn, brittlebush, and burrowbush.

This unit is poorly suited to homesite development. The main limitation is the hazard of flooding.

If this unit is used for septic tank absorption fields, the main limitations are the hazard of ground water contamination because of seepage and flooding.

This map unit is in capability subclass VIIw. It is in the Sandy Bottom, 2- to 7-inch p.z., range site.

6—Cherioni-Rock outcrop complex, 25 to 70 percent slopes. This map unit is on hillslopes. The vegetation is mainly creosotebush, brittlebush, fiddleneck, and annual forbs (fig. 3). Elevation is 400 to 2,500 feet.

Included in this unit are small areas of Carrizo, Chuckawalla, Gunsight, Laposa, Rositas, and Superstition soils. Also included are small areas of soils that have slopes of more than 45 percent and have a coating of silica and lime less than 1 inch thick on the bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

This unit is 60 percent Cherioni extremely stony sandy loam and 25 percent Rock outcrop. The Cherioni soil is on the moderately steep to steep back slopes, and Rock outcrop is on the summits and shoulders of hills. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The Cherioni soil is very shallow and shallow and is well drained. It formed in alluvium and colluvium derived dominantly from basalt, andesite, rhyolite, schist, and andesitic and rhyolitic tuff. Typically, 75 to 85 percent of the surface is covered with stones. The surface layer is light yellowish brown extremely stony sandy loam 3 inches thick. The next layer is very pale brown very gravelly sandy loam 5 inches thick. The underlying material to a depth of 13 inches is a very pale brown,

Figure 2.—Typical area of Carrizo extremely gravelly coarse sand, 0 to 3 percent slopes.

silica- and lime-cemented hardpan. Volcanic bedrock is at a depth of 13 inches.

Permeability of this Cherioni soil is moderate. Available water capacity is very low. Potential rooting depth is 6 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of exposed areas of basalt, andesite, rhyolite, schist, and tuff.

This unit is used as rangeland.

The potential plant community on this unit is dominantly triangle bursage, white brittlebush, creosotebush, ironwood, and cactus.

This unit is poorly suited to desert herbaceous plants and very poorly suited to trees, shrubs, and vines that provide habitat for wildlife.

This map unit is in capability subclass VIIs. It is in the Basalt Hills, 2- to 7-inch p.z., range site.

7—Chuckawalla-Gunsight association, 1 to 45 percent slopes. This map unit is on fan terraces. The native vegetation is mainly creosotebush, turkshead, cactus, brittlebush, and annuals. Elevation is 400 to 2,500 feet.

This unit is 55 percent Chuckawalla extremely gravelly silt loam and 30 percent Gunsight very gravelly sandy loam. The Chuckawalla soil is on gently sloping fan terraces, and the Gunsight soil is on moderately steep and steep sides of fan terraces. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Carrizo, Cherioni, Laposa, Rositas, and Superstition soils and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Chuckawalla soil is deep and well drained. It formed in mixed alluvium derived dominantly from granitic rock. Typically, 70 to 85 percent of the surface is covered with angular pebbles and cobbles that form a desert pavement (fig. 4). The surface layer is light yellowish brown extremely gravelly silt loam 1 inch thick. The subsoil is reddish brown, brown, and light brown, strongly saline extremely gravelly sandy clay loam and very gravelly loam 21 inches thick. The underlying material to a depth of 60 inches or more is light brown, strongly saline extremely stony loamy sand.

Permeability of this Chuckawalla soil is moderately slow. Available water capacity is very low. Potential rooting depth is 60 inches or more. Runoff is rapid, and the hazards of water erosion and soil blowing are slight.

The Gunsight soil is deep and well drained. It formed in mixed alluvium derived dominantly from granitic rock. Typically, 40 to 70 percent of the surface is covered with angular pebbles and cobbles. The surface layer is light yellowish brown, moderately alkaline very gravelly sandy loam 2 inches thick. The subsoil is pink and very pale brown, moderately alkaline and strongly alkaline gravelly sandy clay loam and extremely gravelly clay loam 17 inches thick. The underlying material to a depth of 60

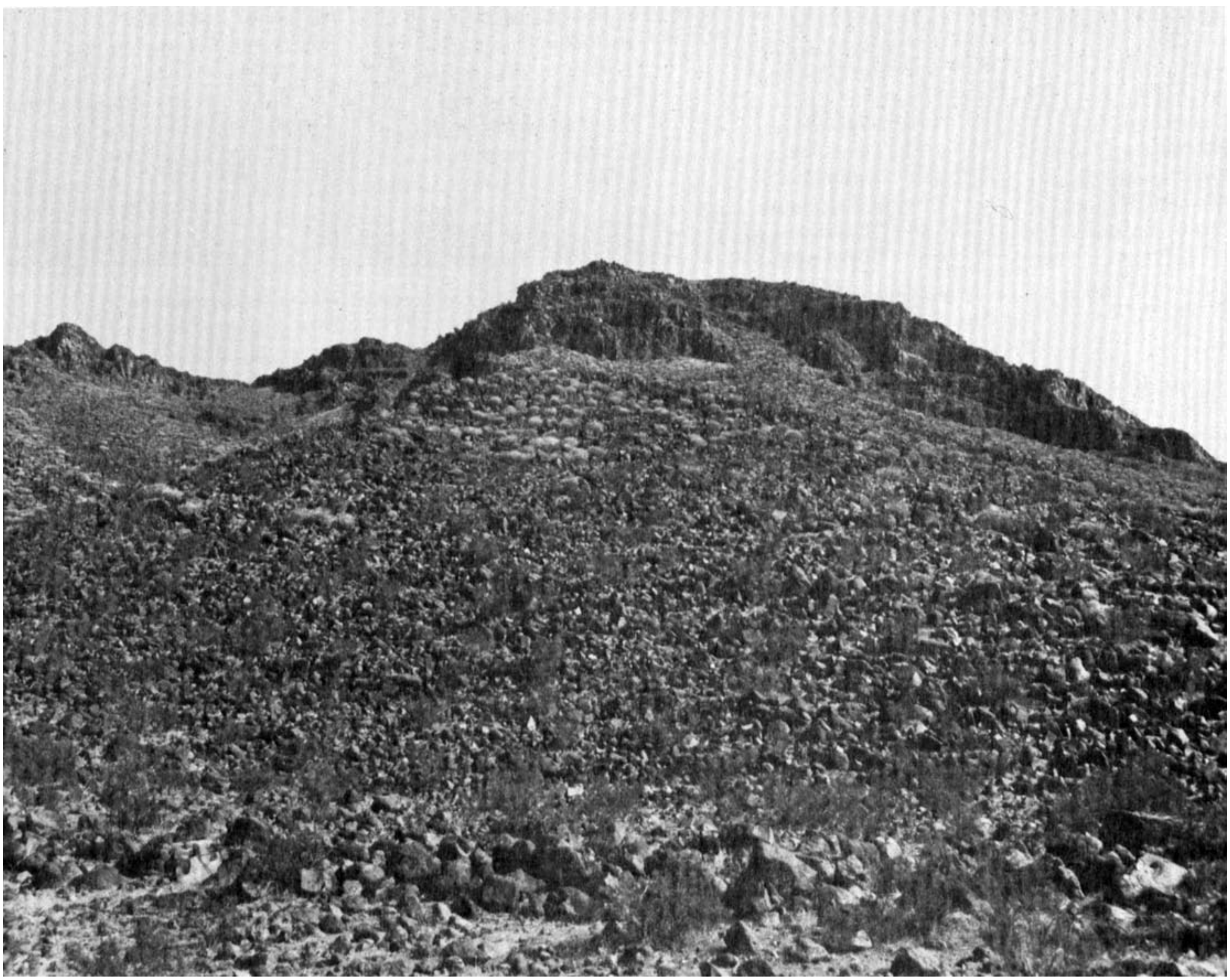


Figure 3.—Typical area of Cherioni-Rock outcrop complex, 25 to 70 percent slopes. The Cherioni soil supports sparse triangle bursage and white brittlebush.

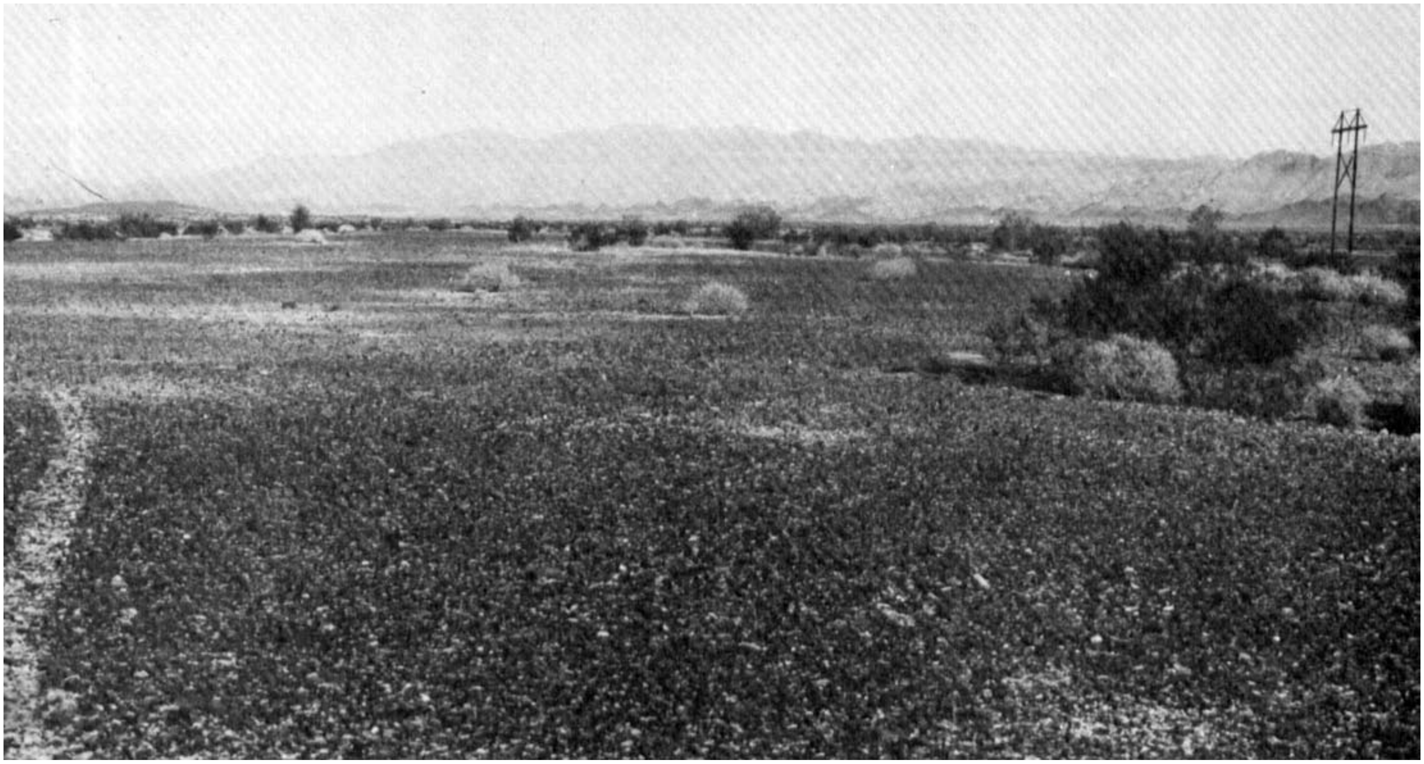


Figure 4.—Desert pavement on the Chuckawalla soil in Chuckawalla-Gunsight association, 1 to 45 percent slopes.

inches or more is pale brown, moderately alkaline extremely gravelly sandy loam.

Permeability of this Gunsight soil is moderate. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

This unit is used as rangeland and for homesite development. It is poorly suited to desertic herbaceous plants and desertic shrubs and trees.

The Chuckawalla soil produces no usable forage; therefore, it is not considered to be rangeland. The potential natural plant community on the Gunsight soil is dominantly creosotebush and sparse triangle bursage, white bursage, and bush muhly.

This unit is poorly suited to irrigated crops. The main limitations are the content of gravel, content of toxic salts, and steepness of slope.

This unit is moderately suited to homesite development. The main limitations are steepness of slope and the content of rock fragments. The rock fragments in the soil interfere with excavation, especially with the preparation of building sites and the installation of underground utilities. This limitation can be easily overcome by using heavy equipment. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. The possibility of settlement can be minimized by compacting the building site before beginning construction. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Irrigation is needed. Select lawn grasses, shrubs, and trees that tolerate excessive amounts of salt.

If this unit is used for septic tank absorption fields, the main limitations are slope and the hazard of ground water contamination because of seepage. Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of ground water as a result of seepage of effluent from onsite sewage disposal systems.

This map unit is in capability subclass VIIs. The Chuckawalla soil is not placed in a range site. The Gunsight soil is in the Limy Upland, 2- to 7-inch p.z., range site.

8—Cibola-Agualt clay loams, 0 to 1 percent slopes. This map unit is on flood plains. Elevation is 250 to 400 feet.

This unit is 65 percent Cibola clay loam and 20 percent Agualt clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Gilman, Glenbar, Holtville, Kofa, Lagunita, Ripley, and Vint soils. Also included are small areas of soils that are strongly saline. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The deep, well drained Cibola soil is on flood plains. It formed in mixed alluvium. Typically, the surface layer is brown clay loam about 8 inches thick. The next 27 inches is stratified, light yellowish brown, light brown, brown, and very pale brown silt loam, silty clay loam, and loam that have thin strata of sand. Below this to a depth of 60 inches or more is pink fine sand that has thin strata of silt 0.5 inch thick or more. A few reddish brown mottles are below a depth of about 30 inches in some pedons areas.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Permeability of this Cibola soil is moderately slow to a depth of 35 inches and rapid below this depth. Available water capacity is moderate. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

The deep, well drained Agualt soil is on flood plains. It formed in mixed alluvium. Typically, the surface layer is light yellowish brown clay loam about 9 inches thick. The next layer is light brown and pale brown very fine sandy loam and loam 19 inches thick. Below this to a depth of 60 inches or more is pink sand that has thin strata of silt 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 30 inches.

Permeability of this Agualt soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly alfalfa, cotton, lettuce, cantaloupe, wheat, grain sorghum, and onions.

This unit is suited to irrigated crops. It is limited mainly by the moderate available water capacity and depth to sand. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. If this unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seed for such crops as lettuce and other vegetables and melons. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize leaching of plant nutrients. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Subsoiling temporarily improves water infiltration and allows salts to be leached downward. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases water intake rate, reduces runoff, and increases available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth.

This map unit is in capability subclasses IIs, irrigated, and VIIs, nonirrigated.

9—Gadsden silty clay, 0 to 1 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 250 to 400 feet.

Typically, the surface layer is brown silty clay about 12 inches thick. The underlying material to a depth of 60 inches or more is pale brown and light yellowish brown clay that has thin strata of silt 0.5 inch thick or more.

Included in this unit are small areas of Cibola, Glenbar, Holtville, Kofa, Meloland, and Ripley soils. Also included are small areas of soils that are strongly saline and soils that have a surface layer of loam.

Permeability of this Gadsden soil is slow. Available water capacity is high. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but the soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly cotton, alfalfa, grain sorghum, and lettuce.

This unit is moderately suited to irrigated crops. It is limited mainly by slow water intake rate and slow permeability. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seed for such crops as lettuce and other vegetables and melons. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize leaching of plant nutrients. Irrigation water needs to be applied at a slow rate over a long period to ensure that the root zone is properly wetted. To avoid overirrigation, applications of water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Because of the slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water and the application of water should be regulated so that water does not stand on the surface and damage the crops.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth.

This map unit is in capability subclasses IIIs, irrigated, and VIIs, nonirrigated.

10—Gadsden silty clay, strongly alkaline, 0 to 1 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly mesquite, saltcedar, arrowweed, alkali seepweed, and saltbush. Elevation is 250 to 400 feet.

Typically, the surface layer is light reddish brown, strongly saline silty clay 7 inches thick. The underlying material to a depth of 60 inches or more is pale brown and light yellowish brown, strongly saline clay that has thin strata of silt 0.5 inch thick or more.

Included in this unit are small areas of Glenbar, Holtville, Kofa, Meloland, and Ripley soils.

Permeability of this Gadsden soil is slow. Available water capacity is very low because of the excessive amount of salts in the soil. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but the soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used as rangeland and for homesite development. The unit can be used for irrigated crops if the land is cleared, water is made available, and excess salts are removed. This unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this Gadsden soil is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the soil dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending to a depth of 20 to 30 feet. Because this soil is on flood plains, the water table often is at this depth. The soil therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitations are content of toxic salts, slow permeability, and slow water intake rate. The unit is moderately suited to most irrigated crops after the toxic salts are removed. An intensive onsite investigation is desirable if land leveling cuts are made. Salinity influences the choice of crops. Reclaiming and improving the soil in this unit involves several years of leaching and growing a salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil condition enough to grow other adapted crops that provide good yields. Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition.

This unit is poorly suited to homesite development. The main limitations are high shrink-swell potential, low soil strength, and the hazard of flooding. Select lawn grasses, shrubs, and trees that tolerate excessive amounts of toxic salts.

If this unit is used for septic tank absorption fields, the main limitations are slow permeability and the hazard of flooding. Use of sandy backfill for the trench and long absorption lines helps to compensate for the slow permeability. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. The effects of shrinking and swelling can be minimized by using

proper engineering designs and by backfilling with material that has low shrink-swell potential.

This map unit is in capability subclasses VIIs, nonirrigated, and IVs irrigated. It is in the Saline Bottom, 2- to 7-inch p.z., range site.

11—Gilman fine sandy loam, 0 to 1 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 250 to 400 feet.

Typically, the surface layer is brown fine sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown and brown loam and very fine sandy loam that have thin strata of finer or coarser textured material 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 30 inches.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small area of Agualt, Cibola, Glenbar, Holtville, Lagunita, Ripley, and Vint soils. Also included are small areas of saline soils and soils that have a surface layer of loamy fine sand.

Permeability of this Gilman soil is moderate. Available water capacity is high. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but the soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly cotton, alfalfa, wheat, lettuce, grain sorghum, cantaloupe, and onions (fig. 5).

This unit is well suited to irrigated crops. It has few limitations. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seeds for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinker irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Irrigation water needs to be applied at a rate that

Figure 5.—Alfalfa on Gilman fine sandy loam, 0 to 1 percent slopes, one of the highest producing soils in the survey area.

ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Subsoiling temporarily improves water infiltration and allows salts to be leached downward.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff and soil blowing, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

This map unit is in capability class I, irrigated, and in capability subclass VIIe, nonirrigated.

12—Gilman fine sandy loam, strongly saline, 0 to 3 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly mesquite, saltcedar, arrowweed, and saltbush. Elevation is 250 to 400 feet.

Typically, the surface layer is light yellowish brown, strongly saline fine sandy loam 9 inches thick. The underlying material to a depth of 60 inches or more is brown and light yellowish brown, strongly saline very fine sandy loam and loam that have thin strata of finer and coarser textured material 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 30 inches.

Included in this unit are small area of Agualt, Cibola, Glenbar, Holtville, Lagunita, Ripley, and Vint soils.

Permeability of this Gilman soil is moderate. Available water capacity is very low because of the excessive amount of salts in the soil. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but the soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used as rangeland and for homesite development. The unit can be used for irrigated crops if the land is leveled and water is made available. This unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the soil dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending to a depth of 20 to 30 feet. Because the soil is on flood plains, the water table often is at this depth. The soil therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitation is the content of toxic salts. The unit is well suited to most irrigated crops after the toxic salts have been removed. An intensive onsite investigation is needed if land leveling cuts are to be made. Salinity influences the choice of crops. Reclaiming and improving the soil in this unit involves several years of leaching and growing salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil condition enough to grow other adapted crops that provide good yields. After the soil is reclaimed, normal high level management should be used to maintain good soil tilth and crop yields. Soil blowing can be reduced by keeping the soil rough and cloddy when it is not protected by vegetation.

This unit is poorly suited to homesite development. The main limitation is the hazard of flooding. When landscaping select lawn grasses, shrubs, and trees that tolerate excessive amounts of toxic salts. The possibility of settlement can be minimized by compacting the building site before beginning construction.

If this unit is used for septic tank absorption fields, the main limitations are the hazard of flooding and seepage potential. If the density of housing is moderate to high, community sewage disposal systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

This map unit is capability subclasses VIIs, nonirrigated, and IVs, irrigated. It is in the Saline Bottom, 2- to 7-inch p.z., range site.

13—Gilman clay loam, 0 to 1 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 250 to 400 feet.

Typically, the surface layer is pale brown clay loam about 13 inches thick. The underlying material to a depth of 60 inches or more is brown and light yellowish brown very fine sandy loam and loam that have thin strata of finer and coarser textured material 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 30 inches.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet

deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small areas of Agualt, Cibola, Glenbar, Holtville, Lagunita, Ripley, and Vint soils. Also included are small areas of soils that are strongly saline.

Permeability of this Gilman soil is moderate. Available water capacity is high. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but the soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly alfalfa, cotton, wheat, lettuce, grain sorghum, cantaloupe, and onions.

This unit is well suited to irrigated crops. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seeds for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinkler irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Subsoiling temporarily improves the water intake rate and allows salts to be leached downward.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff and soil blowing, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth.

This map unit is in capability class I, irrigated, and in capability subclass VIIe, nonirrigated.

14—Glenbar silt loam, 0 to 1 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 250 to 400 feet.

Typically, the surface layer is pale brown silt loam about 12 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, pale brown, and light yellowish brown silt loam that have thin strata of sand and silty clay loam 0.5 inch thick or more. A few reddish brown relict mottles are in some pedons below a depth of about 30 inches.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small area of Agualt, Cibola, Gadsden, Gilman, Holtville, Kofa, Lagunita, Meloland, and Vint soils. Also included are small areas of soils that are strongly saline and soils that have a surface layer of loamy fine sand or silty clay loam.

Permeability of the Glenbar soil is moderately slow. Available water capacity is high. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but the soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly cotton, alfalfa, wheat, grain sorghum, lettuce, cantaloupe, and onions (fig 6).

This unit is well suited to irrigated crops. It has few limitations. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seeds for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinkler irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Subsoiling temporarily improves water infiltration and allows salts to be leached downward.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a

Figure 6.—Wheat in an area of Glenbar silt loam, 0 to 1 percent slopes, that has been leveled.

few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve or maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth.

This map unit is in capability class I, irrigated, and in capability subclass VIIe, nonirrigated.

15—Glenbar fine sandy loam, strongly saline, 0 to 3 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium.

The vegetation in areas not cultivated is mainly mesquite, saltcedar, arroweed, saltbush, and alkali seepweed. Elevation is 250 to 400 feet.

Typically, the surface layer is pale brown strongly saline silt loam 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, pale brown, and light yellowish brown, strongly saline silt loam that has thin strata of sand and silty clay loam 0.5 inch thick or more. A few reddish brown mottles are in some pedons below a depth of about 30 inches.

Included in this unit are small areas of Agualt, Cibola, Gadsden, Gilman, Holtville, Kofa, Lagunita, Meloland, and Vint soils.

Permeability of this Glenbar soil is moderately slow. Available water capacity is very low because of the excessive amount of salts in the soil. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but the soil is still subject

to flooding from the river and from the washes that drain into the river.

This unit is used mainly as rangeland, but some areas are used for homesite development. The unit can be used for irrigated crops if the land is leveled and water is made available. This unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the unit dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending to a depth of 20 to 30 feet. Because this unit is on flood plains, the water table often is at this depth. The soil therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitation is the content of toxic salts. This unit is well suited to most irrigated crops after the toxic salts have been removed. An intensive onsite investigation is needed if land leveling cuts are to be made. Salinity influences the choice of crops. Reclaiming and improving the soil in this unit involves several years of leaching and growing salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil tilth enough to grow other adapted crops that provide good yields. After the soil is reclaimed, normal high level management should be used to maintain good soil tilth and crop yields.

This unit is moderately suited to homesite development. The main limitations are shrink-swell potential, low soil strength, and the hazard of flooding. If the unit is landscaped, select lawn grasses, shrubs, and trees that tolerate excessive amounts of salts. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. The possibility of settlement can be minimized by compacting the building site before beginning construction.

If this unit is used for septic tank absorption fields, the main limitations are moderately slow permeability and the hazard of flooding. Use of sandy backfill for the trench and long absorption lines helps to compensate for the moderately slow permeability. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

This map unit is capability subclasses, VIIs, nonirrigated, and IVs, irrigated. The unit is in the Saline Bottom, 2- to 7-inch p.z., range site.

16—Gunsight very gravelly sandy loam, 15 to 60 percent slopes. This deep, well drained soil is on hillslopes and fan terraces. It formed in gravelly alluvium derived from various kinds of rock including rhyolite, basalt, granite, andesite, schist, and gneiss. Elevation is 400 to 1,000 feet.

The surface layer is light yellowish brown, moderately alkaline very gravelly sandy loam 2 inches thick. The subsoil is pink and very pale brown, moderate alkaline and strongly alkaline gravelly sandy clay loam and extremely gravelly sandy clay loam 17 inches thick. The underlying material to a depth of 60 inches or more is pale brown, moderately alkaline extremely gravelly sandy loam.

Included in this unit are small areas of Carrizo, Cherioni, Chuckawalla, Laposa, Rositas, and Superstition soils.

Permeability of this Gunsight soil is moderate. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

This unit is used as rangeland and for homesite development. The unit is poorly suited to desertic herbaceous plants and desertic trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly creosotebush, but there is some triangle bursage, white bursage, and bush muhly.

This unit is poorly suited to irrigated crops. The main limitations are the content of gravel, low available water capacity, and steepness of slope.

This unit is moderately suited to homesite development. The main limitations are steepness of slope and the content of rock fragments. Excavation for roads and buildings increases the risk of erosion. The rock fragments in the soil interfere with excavation, especially with preparation for building sites and installation of underground utilities. This limitation can be easily overcome by using heavy equipment. Only the part of the site that is used for construction should be disturbed. Removal of rock fragments in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Irrigation is needed for successful growth. The possibility of settlement can be minimized by compacting the building site before beginning construction.

If this unit is used for septic tank absorption fields, the main limitation is slope. Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. Absorption lines should be installed on the contour. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

This map unit is in capability subclass VIIs. It is in the Limy Upland, 2- to 7-inch p.z., range site.

17—Gunsight-Chuckawalla-Carrizo association, 1 to 45 percent slopes. This map unit is on hillslopes, fan terraces, and flood plains. The present vegetation is mainly creosotebush, turkshead, cactus, brittlebush, paloverde, and annuals. Elevation is 400 to 2,500 feet.

This unit is 45 percent Gunsight very gravelly sandy loam, 25 percent Chuckawalla extremely gravelly silt loam, and 15 percent Carrizo extremely gravelly coarse sand. The Gunsight soil is on gently sloping to steep hillslopes, the Chuckawalla soil is on gently sloping fan terraces, and the Carrizo soil is on nearly level flood plains. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cherioni, Laposa, Rositas, and Superstition soils and Rock outcrop. These included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Gunsight soil is deep and well drained. It formed in mixed alluvium derived dominantly from granitic rock. Typically, 40 to 70 percent of the surface layer is covered with pebbles and cobbles. The surface layer is light yellowish brown, moderately alkaline very gravelly sandy loam 2 inches thick. The subsoil is pink and very pale brown, moderately alkaline to strongly alkaline gravelly sandy clay and extremely sandy clay loam about 17 inches thick. The underlying material to a depth of 60 inches or more is pale brown, moderately alkaline extremely gravelly sandy loam.

Permeability of this Gunsight soil is moderate. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Chuckawalla soil is deep and well drained. It formed in mixed alluvium derived dominantly from granitic rock. Typically, 70 to 95 percent of the surface layer is covered with pebbles and cobbles that form a desert pavement. The surface layer is light yellowish brown, extremely gravelly silt loam 1 inch thick. The subsoil is reddish brown, brown, and light brown, strongly saline extremely gravelly sandy clay loam and very gravelly loam 21 inches thick. The underlying material to a depth of 60 inches or more is light brown, saline extremely gravelly loamy sand.

Permeability of this Chuckawalla soil is moderately slow. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is none to slight. The hazard of soil blowing is slight.

The Carrizo soil is deep and excessively drained. It formed in recent alluvium derived from mixed sources including granite, rhyolite, basalt, andesite, schist, and gneiss. From 65 to 75 percent of the surface is covered with pebbles. The surface layer is light grayish brown extremely gravelly coarse sand 5 inches thick. The underlying material to a depth of 60 inches or more is light grayish brown, light yellowish brown, brown, and grayish brown very gravelly loamy coarse sand that has thin strata of fine sandy loam and sandy loam 0.5 inch thick or more.

Permeability of this Carrizo soil is very rapid. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is very slow. The hazard of soil blowing is slight. This soil is subject to occasional, very brief periods of flooding nearly anytime during the year, but primarily in June through October.

This unit is used as rangeland and for homesite development. It is poorly suited to desertic herbaceous plants and is moderately suited to desertic trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on the Gunsight soil is dominantly creosotebush, but there is some white bursage and bush muhly.

The Chuckawalla soil produces no forage.

The potential plant community on the Carrizo soil is dominantly desert ironwood, desertthorn, brittlebush, and burrowbush.

This unit is poorly suited to irrigated crops. The main limitations are the content of gravel, the content of salts, and the steepness of slope.

This unit is moderately suited to homesite development. The main limitations are steepness of slope, the content of rock fragments, and flooding on the Carrizo soil. Excavating for roads and buildings increases the risk of erosion. The rock fragments in the soil interfere with excavation, especially with the preparation of building sites and the installation of underground utilities. This limitation can be easily overcome by using heavy equipment. Erosion is a hazard in the steeper areas. Only part of the site that is used for construction should be disturbed.

Removal of the rock fragments in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Irrigation is needed for best results. Select lawn grasses, shrubs, and trees that tolerate excessive amounts of toxic salts. The possibility of settlement can be minimized by compacting the building site before beginning construction.

If this unit is used for septic tank absorption fields, effluent can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, community sewage disposal systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Homesites and septic tanks should not be located on the Carrizo soil because of the hazard of flooding.

This map unit is in capability subclass VIIs. The Gunsight soil is in the Limy Upland, 2- to 7-inch p.z.,

range site. The Chuckawalla soil is not placed in a range site. The Carrizo soil is in the Sandy Bottom, 2- to 7-inch p.z., range site.

18—Holtville-Kofa complex, 0 to 1 percent slopes. This map unit is on flood plains. Elevation is 250 to 400 feet.

This unit is 55 percent Holtville silty clay loam and 30 percent Kofa clay. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cibola, Gadsden, Glenbar, Meloland, and Ripley soils. Also included are small, recently cultivated areas of soils that are strongly saline and small areas of soils that have a surface layer of loamy fine sand, sandy loam, or clay. Included areas make up 15 percent of the total acreage. The percentage varies from one area to another.

The deep, well drained Holtville soil is on flood plains. It formed in mixed alluvium. Typically, the surface layer is brown silty clay loam 7 inches thick. The upper 25 inches of the underlying material is light reddish brown and pale brown silty clay and clay, and the lower part to a depth of 60 inches or more is very pale brown loam that has thin strata of silt.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Permeability of this Holtville soil is slow to a depth of 32 inches and moderate below this depth. Available water capacity is high. Effective rooting depth of 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

The deep, well drained Kofa soil is on flood plains. It formed in mixed alluvium. Typically, the surface layer is grayish brown clay 10 inches thick. The upper 20 inches of the surface layer is brown clay and grayish brown silty clay, and the lower part to a depth of 33 inches is light yellowish brown very fine sandy loam. The underlying material to a depth of 60 inches or more is very pale brown sand. Thin strata of silt are common below a depth of about 22 inches.

Permeability of this Kofa soil is slow to a depth of 30 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly cotton, alfalfa, wheat, grain sorghum, and lettuce.

This unit is moderately well suited to irrigated crops. It is mainly limited by the slow permeability, slow water intake rate, and depth to sand in the Kofa soil. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. If this unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seeds for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinkler irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. Water needs to be applied at a slow rate over a long period of time to ensure that the root zone is properly wetted. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Because of the slow permeability of the soils in this unit, the length of runs should be adjusted to permit adequate infiltration of water. Also, the application of water should be regulated so that water does not stand on the surface and damage the crops. Salinity influences the choice of crops. Subsoiling temporarily improves water infiltration and allows salts to be leached downward.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth.

This map unit is in capability subclasses IIIs, irrigated, VIIs, nonirrigated.

19—Holtville-Kofa complex, strongly saline, 0 to 3 percent slopes. This map unit is on flood plains. The vegetation in areas not cultivated is mainly mesquite, saltcedar, paloverde, saltbush, and alkali seepweed. Elevation is 250 to 400 feet.

This unit is 60 percent Holtville silty clay loam and 25 percent clay. The components of this unit are so

intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cibola, Gadsden, Glenbar, Meloland, and Ripley soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The deep, well drained Holtville soil is on flood plains. It formed in mixed alluvium. Typically, the surface layer is brown, strongly saline silty clay loam 9 inches thick. The upper 23 inches of the underlying material is light reddish brown and pale brown, strongly saline silty clay and clay, and the lower part to a depth of 60 inches or more is very pale brown loam that has thin strata of silt.

Permeability of the Holtville soil is slow to a depth of 32 inches and moderate below this depth. Available water capacity is very low because of the excessive amount of salts in the soil. Effective rooting depth of 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

The deep, well drained Kofa soil is on flood plains. It formed in mixed alluvium. Typically, the surface layer is grayish brown, strongly saline clay 5 inches thick. The upper 25 inches of the underlying material is brown, strongly saline clay and grayish brown, strongly saline silty clay, and the lower part to a depth of 33 inches is light yellowish brown, strongly saline very fine sandy loam. The underlying material to a depth of 60 inches or more is very pale brown, strongly saline sand. Thin strata of silt are common below a depth of about 22 inches.

Permeability of the Kofa soil is slow to a depth of 30 inches and rapid below this depth. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used as rangeland. Some areas are used for homesite development. The unit can be used for irrigated crops if the land is leveled, water is made available, and toxic salts are removed. This unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the unit dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending 20 to 30 feet. Because this unit is on flood plains, the water table often is at this depth. The unit therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitations are the content of toxic salts, slow permeability, and very low available water capacity. This unit is moderately well suited to most irrigated crops after the toxic salts are removed. An intensive onsite investigation is needed if land leveling cuts are to be made. If the unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material. If the unit is irrigated, salinity influences the choice of crops.

Reclaiming and improving the soil in this unit involves several years of leaching and growing a salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil condition enough to grow other adapted crops that provide good yields. Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition.

This unit is poorly suited to homesite development. The main limitations are shrink-swell potential, content of toxic salts, and the hazard of flooding. Select lawn grasses, shrubs, and trees that tolerate toxic salts. If the unit is used for septic tank absorption fields, the main limitations are slow permeability and the hazard of flooding. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. The effects of shrinking and swelling can be minimized by using proper engineering and by backfilling with material that has low shrink-swell potential.

This map unit is in capability subclass VIIs. It is in the Saline Bottom, 2- to 7-inch p.z., range site.

20—Lagunita loamy sand, 0 to 1 percent slopes. This, deep somewhat excessively drained soil is on flood plains. It formed in mixed alluvium. Elevation is 250 to 400 feet.

Typically, the surface layer is light yellowish brown loamy sand 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. Thin strata of sand 0.25 inch thick or more are common in this soil.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Permeability of this Lagunita soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is very high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from

the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly alfalfa and wheat.

This unit is poorly suited to irrigated crops. It is limited mainly by the very low available water capacity and sandy texture. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made.

If this unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places. Sprinkler irrigation is the most suitable method of applying water. If furrow irrigation is used, water should be applied at frequent intervals and runs should be short. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation or runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Tillage should be kept to a minimum. Soil blowing can be reduced by returning crop residue to the soil, practicing minimum tillage, and planting a close growing cover crop.

This map unit is in capability subclasses IVs, irrigated, and VIIs, nonirrigated.

21—Lagunita loamy sand, strongly saline, 0 to 5 percent slopes. This deep, somewhat excessively drained soil is on flood plains. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly creosotebush, mesquite, fourwing saltbush, sandverbena, globemallow, and annual forbs. Elevation is 250 to 400 feet.

Typically, the surface layer is light yellowish brown, strongly saline loamy sand 7 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, strongly saline fine sand that has thin strata of sand. In undisturbed areas the surface commonly has been reworked by the wind and is hummocky.

Included in this unit are small areas of Agualt, Antho, Cibola, Gilman, Kofa, Ripley, and Vint soils.

Permeability of this Lagunita soil is rapid. Available water capacity is very low. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is very high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used as rangeland. Some areas are used for homesite development. The unit can be used for irrigated crops if water is made available and areas of the unit cannot be excluded from development with the rest of the field. This unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the unit dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending 20 to 30 feet. Because this unit is on flood plains, the water table often is at this depth. The unit therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitations are the sandy texture, the content of toxic salts, and the very low available water capacity. This unit is poorly suited to most irrigated crops even after the toxic salts are removed. An intensive onsite investigation is needed if land leveling cuts are to be made. If this unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places. Salinity influences the choice of crops.

Reclaiming and improving the soil in this unit involves several years of leaching and growing a salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil condition enough to grow other adapted crops that provide good yields. Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original condition.

This unit is poorly suited to homesite development. The main limitation is the hazard of flooding. Select lawn grasses, shrubs, and trees that can tolerate excessive amounts of salt. The possibility of settlement can be minimized by compacting the building site before beginning construction. Cutbanks are not stable and are subject to slumping. If this unit is used for septic tank absorption fields, the main limitations are poor filtration of effluent, potential ground water contamination, and the hazard of flooding.

This map unit is in capability subclasses VIIs, nonirrigated, and IVs, irrigated. This unit is in the Saline Bottom, 2- to 7-inch p.z., range site.

22—Lagunita Variant loamy sand, 0 to 3 percent slopes. This deep, poorly drained soil is on flood plains. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly cattails, reeds, sedges, mesquite, saltcedar, and arrowweed. Elevation is 250 to 400 feet.

Typically, the surface layer is light yellowish brown, moderately saline loamy sand 6 inches thick. The underlying material to a depth of 60 inches or more is light gray, moderately saline fine sand.

Included in this unit are small areas of Agualt, Gilman, Ripley, and Vint soils.

Permeability of this Lagunita Variant soil is rapid. Available water capacity is very low. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is very high when the surface is not ponded. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river. A water table that ranges from surface ponding to 2 feet below the surface occurs throughout the year.

This unit is used as rangeland. Some areas are used for homesite development. The unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on the soil in this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the soil dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending to a depth of 20 to 30 feet. Because the water table is at a shallow depth throughout the year, the soil is capable of producing very large amounts of vegetation.

Because this unit is near the Colorado River and the water table is at a shallow depth throughout the year, it is not suitable for development as cultivated land.

This unit is poorly suited to homesite development. The main limitations are wetness and the hazard of flooding. Drainage and protection from flooding are needed if roads and building foundations are constructed. If this unit is used for septic tank absorption fields, the main limitations are wetness, the hazard of flooding, and seepage potential.

This map unit is in capability subclass VIIw. It is in the Saline Bottom, 2- to 7-inch p.z., range site.

23—Laposa-Rock outcrop complex, 15 to 75 percent slopes. This map unit is on hillslopes. The present vegetation is mainly creosotebush, white bursage, ocotillo, and cactus. Elevation is 400 to 2,500 feet.

This unit is 60 percent Laposa extremely gravelly sandy loam and 25 percent Rock outcrop. The Laposa soil is on hilly to very steep foot slopes, toe slopes, and back slopes, and Rock outcrop is on the summits and shoulders of hills. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Carrizo, Cherioni, Chuckawalla, Gunsight, Rositas, and Superstition soils. Also included is soils that are less than 20 inches deep to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Laposa soil is moderately deep and well drained. It formed in alluvium and colluvium derived dominantly from granite, gneiss, schist, andesite, and rhyolite. Typically, 60 to 75 percent of the surface layer is covered with pebbles and a few cobbles. The surface layer is light yellowish brown extremely gravelly sandy loam 3 inches thick. The underlying material to a depth of 21 inches is pale brown and light gray extremely gravelly sandy loam. Granitic bedrock is at a depth of 21 inches.

Permeability of this Laposa soil is moderately rapid. Available water capacity is very low. Potential rooting depth is 20 to 35 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

Rock outcrop consists of exposed areas of granite, gneiss, schist, andesite, and rhyolite.

This unit is used as rangeland. It is poorly suited to riparian herbaceous plants and moderately suited to riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly creosotebush, ocotillo, and white bursage.

This map unit is in capability subclass VIIs. The Laposa soil is in the Granitic Hills, 2- to 7-inch p.z., range site. Rock outcrop is not placed in a capability subclass or range site.

24—Meloland sandy loam. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Slope is 0 to 1 percent. Elevation is 250 to 400 feet.

Typically, the surface layer is grayish brown sandy loam 8 inches thick. The next layer is brown, pale brown, and light yellowish brown, stratified sandy loam to clay loam 22 inches thick. The underlying material to a depth of 60 inches or more is brown clay.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small areas of Cibola, Gadsden, Glenbar, Holtville, and Kofa soils. Also included are areas of soils that are strongly saline.

Permeability of this Meloland soil is moderate to a depth of 30 inches and slow below this depth. Available water capacity is high. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly cotton, alfalfa, lettuce, wheat, grain sorghum, and onions.

This unit is moderately suited to irrigated crops. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made.

Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seeds for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinkler irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize leaching of plant nutrients. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crops needs. Because of the slow permeability of this soil, the length of runs should be adjusted to permit adequate infiltration of water. The application of water should be regulated so that water does not stand on the surface or a temporary high water table does not develop and thus damage the crops. Subsoiling temporarily improves the water infiltration and allows salt to be leached downward.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff and soil blowing, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

This map unit is in capability subclasses IIs, irrigated, and VIIs, nonirrigated.

25—Meloland clay loam. This deep, well drained soil is on flood plains. It formed in alluvium. Slope is 0 to 1 percent. Elevation is 250 to 400 feet.

Typically, the surface layer is grayish brown clay loam 10 inches thick. The next layer is brown, pale brown, and light yellowish brown, stratified sandy loam to clay loam 20 inches thick. The underlying material to a depth of 60 inches or more is brown clay.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small areas of Cibola, Gadsden, Glenbar, and Kofa soils. Also included are small areas of soils that are strongly saline.

Permeability of this Meloland soil is moderate to a depth of 30 inches and slow below this depth. Available water capacity is high. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly cotton, alfalfa, lettuce, wheat, grain sorghum, and onions.

This unit is moderately suited to irrigated crops. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made.

Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seeds for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinkler irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize leaching of plant nutrients. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crops needs. Because of the

slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water. The application of water should be regulated so that water does not stand on the surface or a temporary high water table does not develop and thus damage the crops. Subsoiling temporarily improves the water infiltration and allows salt to be leached downward.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff and soil blowing, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

This map unit is in capability subclasses IIs, irrigated, and VIIs, nonirrigated.

26—Ripley fine sandy loam, 0 to 1 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 250 to 400 feet.

Typically, the surface layer is pale brown fine sandy loam 10 inches thick. The upper 11 inches of the underlying material is very pale brown and light yellowish brown silt loam, and the lower part to a depth of 60 inches or more is pink fine sand and loamy fine sand.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small areas of Aguалt, Gilman, Glenbar, Holtville, Kofa, Lagunita, and Vint soils. Also included are small areas of soils that have been irrigated for only a short time and are still strongly saline.

Permeability of this Ripley soil is moderate to a depth of 21 inches and rapid below this depth. Available water capacity is moderate. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly cotton, alfalfa, lettuce, wheat, grain sorghum, and onions.

This unit is moderately suited to irrigated crops. It is limited mainly by the moderate available water capacity and depth to sand. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made.

If this unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material. Basin, furrow, border, drip, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the kind of crop grown or by the preference of the farmer, or both. Sprinkler irrigation systems are efficient in special situations such as germinating seeds for such crops as lettuce and other vegetables and melons. By keeping the soil surface moist, sprinkler irrigation helps to prevent damage to young seedlings from soil blowing. In addition, it helps to apply water more efficiently and to cool crops and protect them from frost. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize leaching of plant nutrients. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crops needs. Subsoiling temporarily improves the water infiltration and allows salt to be leached downward.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff and soil blowing, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

This map unit is in capability subclasses IIs, irrigated, and VIIs, nonirrigated.

27—Ripley fine sandy loam, strongly saline, 0 to 3 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly mesquite, creosotebush, paloverde, saltcedar, saltbush, and alkali seepweed. Elevation is 250 to 400 feet (fig. 7).

Typically, the surface layer is pale brown, strongly saline fine sandy loam 8 inches thick. The upper 13 inches of the underlying material is very pale brown and light yellowish brown, strongly saline silt loam, and the

Figure 7.—Area of Ripley fine sandy loam, strongly saline, 0 to 3 percent slopes.

lower part to a depth of 60 inches or more is pink, strongly saline fine sand and loamy fine sand.

Included in this unit are small areas of Agualt, Gilman, Glenbar, Holtville, Kofa, Lagunita, and Vint soils.

Permeability of this Ripley soil is moderate to a depth of 32 inches and rapid below this depth. Available water capacity is very low because of the excessive amount of toxic salts in the soil. Potential rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used as rangeland. Some areas are used for homesite development. The unit can be used for irrigated crops if the land is leveled, water is made available, and the toxic salts are removed. This unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on the soil in this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the soil dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending to a depth of 20 to 30 feet. Because the soil is on flood plains, the water table often is at this depth. The soil therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitations are content of toxic salts and depth to sand. The unit is moderately suited to most irrigated crops after toxic salts are removed. An intensive onsite investigation is needed if land leveling cuts are to be made. If this unit is leveled for irrigation, the cuts and fills

can be as much as 3 feet deep in places, which can expose the underlying sandy material. Reclaiming and improving the saline soil in this unit involves several years of leaching and growing a salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil tilth enough to grow other adapted crops that provide good yields. Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may return to its original saline condition. Soil blowing can be reduced by keeping the soil rough and cloddy when it is not protected by vegetation.

This unit is poorly suited to homesite development. The main limitations are low soil strength and the hazard of flooding. Select lawn grasses, shrubs, and trees that can tolerate excessive amounts of salts. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If the soil is used as a base for roads and streets, the upper part can be mixed with the underlying sand to increase its strength and stability. The possibility of settlement can be minimized by compacting the building site before beginning construction. Cutbanks are not stable and are subject to slumping.

This map unit is in capability subclasses VIIs, nonirrigated, and IVs, irrigated. It is in the Saline Bottom, 2- to 7-inch p.z., range site.

28—Superstition gravelly loamy fine sand, 0 to 3 percent slopes. This deep, somewhat excessively drained soil is on stream terraces and fan terraces. It formed in mixed alluvium. The vegetation is mainly creosotebush, turkshead, and big galleta (fig. 8). Elevation is 250 to 400 feet.

Typically, the surface layer is light brown gravelly loamy fine sand 1 inch thick. The underlying material to a depth of 60 inches or more is brown, light brown, light yellowish brown, and very pale brown loamy fine sand, loamy sand, and sand.

Included in this unit are small areas of Carrizo, Chuckawalla, Gunsight, and Rositas soils.

Permeability of this Superstition soil is rapid. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

The hazard of soil blowing is high.

Most areas of this unit are used as rangeland. Some areas are used for homesite development. A few areas

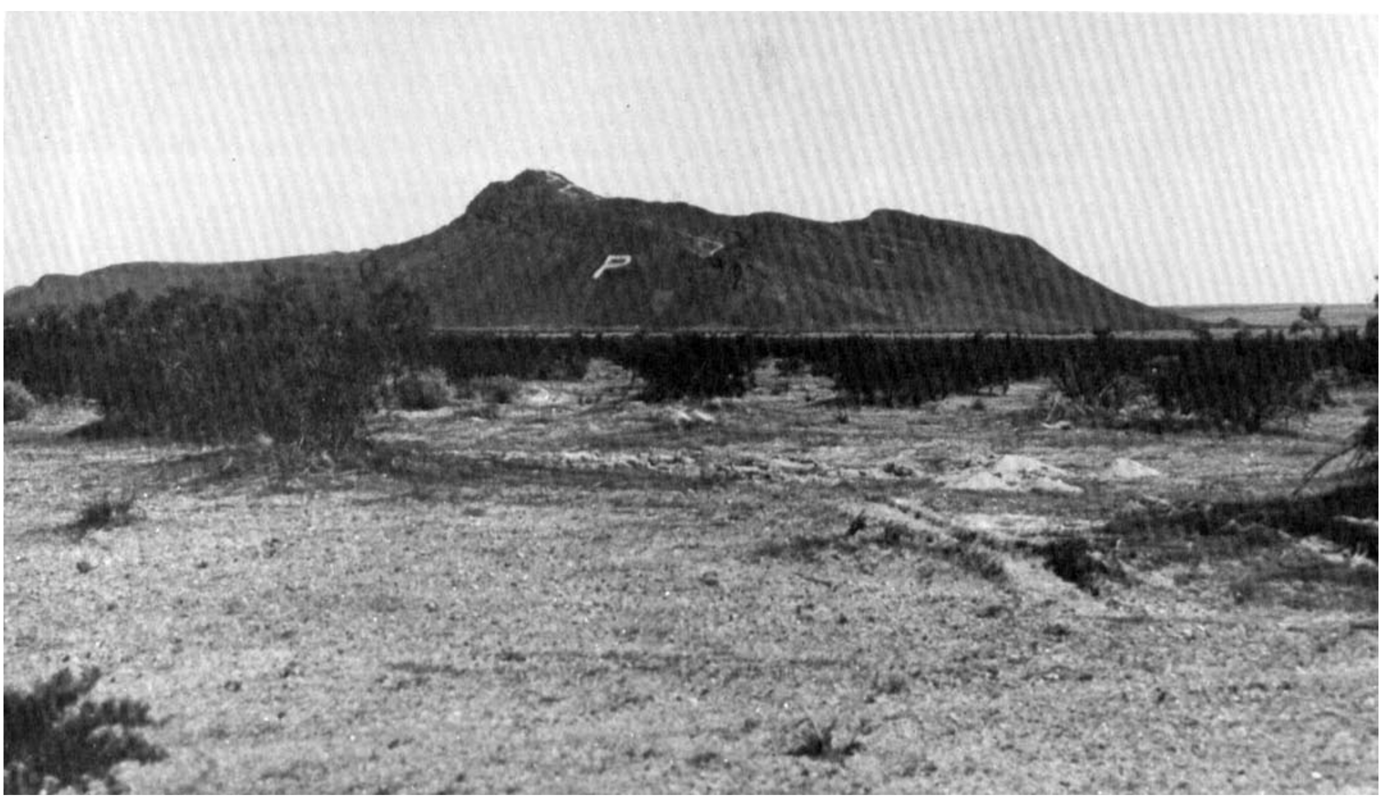


Figure 8.—Area of Superstition gravelly loamy fine sand, 0 to 3 percent slopes.

are used for irrigated crops such as alfalfa, wheat, and cotton. This unit is poorly suited to riparian herbaceous plants and desertic trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly white bursage, big galleta, and creosotebush.

This unit is moderately suited to irrigated crops. It is limited mainly by the low available water capacity, sandy texture, and excessive amount of lime. Year-round irrigation is necessary for the production of all crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff and soil blowing, and increases the available water capacity.

Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Soil blowing can also be reduced by returning crop residue to the soil and practicing minimum tillage.

This unit is well suited to homesite development. It has few limitations. Excavation for roads and buildings increases the hazard of erosion. The possibility of settlement can be minimized by compacting the building site before beginning construction. Cutbanks are not stable and are subject to slumping. If this unit is used for septic tank absorption fields, the main limitation is the hazard of ground water contamination.

This map unit is in capability subclasses IIIs, irrigated, and VIIs, nonirrigated. The unit is in the Limy Fan (Sandy), 2- to 7-inch p.z., range site.

29—Superstition-Rositas association, 0 to 15 percent slopes. This map unit is on fan terraces and stream terraces. The present vegetation is mainly big galleta, creosotebush, turkshead, and annual. Elevation is 400 to 2,500 feet.

This unit is 50 percent Superstition gravelly loamy fine sand and 35 percent Rositas sand. The Superstition soil is in nearly level to gently sloping interdune areas, and the Rositas soil is on gently sloping to moderately steep longitudinal dunes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Carrizo, Chuckawalla, and Gunsight soils and soils that are shallow over basalt. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Superstition soil is deep and somewhat excessively drained. It formed in mixed alluvium derived dominantly from granitic material. The surface layer is light brown gravelly loamy fine sand 1 inch thick. The underlying material to a depth of 60 inches or more is brown, light brown, light yellowish brown, and very pale brown loamy fine sand, loamy sand, and sand.

Permeability of this Superstition soil is rapid. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

The Rositas soil is deep and somewhat excessively drained. It formed in windblown sand derived dominantly from recent alluvium. Typically, the soil is pink sand to a depth of 60 inches or more.

Permeability of this Rositas soil is rapid. Available water capacity is very low. Potential rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This unit is used as rangeland. Some areas are used for homesite development. The unit is poorly suited to desertic herbaceous plants and desertic trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on the Superstition soil is dominantly white bursage, big galleta, and creosotebush.

The potential plant community on the Rositas soil is dominantly big galleta, primrose, white bursage, and sandverbena (fig. 9).

This unit is poorly suited to irrigated crops. The main limitations are slope, low and very low available water capacity, and sandy texture. Sprinkler irrigation is a suitable method of applying water. Because the soils in this unit are droughty, applications of irrigation water should be light and frequent.

This unit is moderately suited to homesite development. The main limitations is the shifting sand on the Rositas soil. The Superstition soil has few limitations. Excavation for roads and buildings increases the risk of erosion. The possibility of settlement can be minimized by compacting the building site before beginning construction. Cutbanks are not stable and are subject to slumping. If this unit is used for septic tank absorption fields, the main limitation is the hazard of ground water contamination. If the density of housing is moderate to high, community sewage disposal systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

Figure 9.—Big galleta on the Rositas soil in Superstition-Rositas association, 0 to 15 percent slopes. The Rositas soil is on dunes.

This map unit is in capability subclasses VIIs, nonirrigated, and IVs, irrigated. The Superstition soil is in the Limy Fan (Sandy), 2- to 7-inch p.z., range site, and the Rositas soil is in the Sandy Upland, 2- to 7-inch p.z., range site.

30—Vint sandy loam, 0 to 1 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. Elevation is 250 to 400 feet.

Typically, the surface layer is light yellowish brown sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown and pale brown, stratified loamy fine sand, loamy very fine sand, and very fine sandy loam.

A substantial amount of soil material in this unit has been moved to facilitate irrigation water management. Maximum cuts and fills commonly are 1 foot to 2 feet deep. In these disturbed areas, the profile does not necessarily resemble the one described as typical.

Included in this unit are small areas of Antho, Agualt, Gilman, Kofa, Meloland, and Ripley soils. Also included are small areas of soils that have a surface layer of loamy sand or clay loam and soils that are strongly saline.

Permeability of this Vint soil is moderately rapid. Available water capacity is low. Potential rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used for irrigated crops, mainly alfalfa, wheat, lettuce, grain sorghum, and cantaloupe.

This unit is moderately suited to irrigated crops. It is limited mainly by the sandy texture and low available water capacity. Year-round irrigation is necessary for the production of all crops. An intensive onsite investigation is needed if land leveling cuts are to be made. If this unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material (fig. 10).

Sprinkler irrigation is a suitable method of applying water. If furrow irrigation is used, water should be applied at frequent intervals and runs should be short. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation and runoff. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original saline condition. Returning all crop residue to the soil or regularly adding other organic material such as gin trash or manure helps to improve and maintain fertility and tilth, reduces crusting, increases the water intake rate, reduces runoff and soil blowing, and increases the available water capacity. Crop residue should be incorporated into the soil and sufficient nitrogen and moisture added to complete the decomposition of the residue before planting the next crop. A cropping system that includes a small grain or legume 1 year out of 3 helps to improve and maintain good soil tilth. Tillage should be kept to a

Figure 10.—Field of cotton on Vint sandy loam in foreground. Leveling cuts can expose contrasting soil material that makes it difficult to evenly distribute irrigation water.

minimum. Soil blowing can be reduced by returning crop residue to the soil, practicing minimum tillage, or planting a close growing cover crop.

This map unit is in capability subclasses IIIs, irrigated, and VIIs, nonirrigated.

31—Vint sandy loam, strongly saline, 0 to 3 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly creosotebush, mesquite, fourwing, saltbush, sandverbena, and annual forbs. Elevation is 250 to 400 feet.

Typically, the surface layer is very pale brown, strongly saline sandy loam 8 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown and pale brown, strongly saline, stratified loamy fine sand, loamy very fine sand, and very fine sandy loam.

Included in this unit are small areas of Agualt, Antho, Cibola, Gilman, Kofa, and Ripley soils.

Permeability of this Vint soil is moderately rapid. Available water capacity is very low because of the excessive amount of salts in the soil. Potential rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The risk of flooding from the Colorado River has been reduced by the installation of dikes, dams, diversions, and levees, but this soil is still subject to flooding from the river and from the washes that drain into the river.

This unit is used as rangeland. Some areas are used for homesite development. The unit can be used for irrigated crops if the land is cleared, water is made available, and the toxic salts are removed. This unit is moderately suited to riparian herbaceous plants and riparian trees, shrubs, and vines that provide habitat for wildlife.

The potential plant community on this unit is dominantly a dense cover of saltcedar, mesquite, and arrowweed. Because the unit dominantly supports shrubs and trees that have little value as forage for livestock, grazing pressure has a minimal effect on the composition of the plant community. The plants present are highly tolerant of salt, and many have taproots capable of extending 20 to 30 feet. Because this unit is on flood plains, the water table often is at this depth. The unit therefore is capable of producing very large amounts of vegetation.

This unit is poorly suited to irrigated crops. The main limitations are the sandy texture, content of toxic salts, and very low available water capacity. This unit is moderately suited to most irrigated crops after the toxic salts are removed. An intensive onsite investigation is needed if land leveling cuts and fills are to be made. If this unit is leveled for irrigation, the cuts and fills can be as much as 3 feet deep in places, which can expose the underlying sandy material. Salinity influences the choice of crops.

Reclaiming and improving the soil in this unit involves several years of leaching and growing a salt tolerant small grain. Yields gradually increase as root development improves. Planting a legume for 1 year to 5 years should improve the soil condition enough to grow other adapted crops that provide good yields. Intensive management is needed to keep soil salinity and sodicity to a minimum and to maintain soil productivity. Land that is not cropped or irrigated for a few years may deteriorate to its original condition.

This unit is poorly suited to homesite development. The main limitation is the hazard of flooding. Lawn grasses, shrubs, and trees that can tolerate excessive amounts of salts should be selected. The possibility of settlement can be minimized by compacting the building site before beginning construction. Cutbanks are not stable and are subject to slumping. If this unit is used for septic tank absorption fields, the main limitations are the hazard ground water contamination and the hazard of flooding.

This map unit is in capability subclasses VIIs, nonirrigated, and IVs, irrigated. It is in the Saline Bottom, 2- to 7-inch p.z., range site.

Prime Farmland

In this section, prime farmland is defined and discussed and the prime farmland soils in this survey area are listed.

Prime farmland is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, seed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. Adequate moisture and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal units of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils commonly get an adequate and dependable supply of moisture from precipitation or irrigation. Temperature and growing season are favorable, and level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. The slope is no more than 5 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

About 82,584 acres, or nearly 31 percent of the survey area, meets the requirements for prime farmland. If an adequate and dependable supply of irrigation water were available and the toxic salts were leached out, another 49,484 acres, or 18 percent of the area, would qualify as prime farmland.

The following map units meet the soil requirements for prime farmland when irrigated. On some soils included in the list, measures should be used to overcome a hazard or limitation such as flooding. The location of each map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

1	Agualt-Cibola sandy loams, 0 to 1 percent slopes
8	Cibola-Agualt clay loams
9	Gadsden silty clay
11	Gilman fine sandy loam, 0 to 1 percent slopes
13	Gilman clay loam, 0 to 1 percent slopes
14	Glenbar silt loam, 0 to 1 percent slopes
18	Holtville-Kofa complex, 0 to 1 percent slopes
24	Meloland sandy loam
25	Meloland clay loam
26	Ripley fine sandy loam, 0 to 1 percent slopes
30	Vint sandy loam, 0 to 1 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Irrigated Crops

Terry Parsons, soil conservationist, Soil Conservation Service, prepared this section.

General management needed for irrigated crops is suggested in this section. The major crops grown in the survey area are identified; the system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 120,982 acres of the survey area is used for irrigated farming. The main crops are cotton, alfalfa hay, lettuce, cantaloupe, grain sorghum, wheat, and onions. Proper use and management of the irrigated soils includes using effective cropping systems, adding organic material, using improved irrigation systems, improving water management, leaching toxic salts, and using minimum tillage.

An effective cropping system maintains crop growth and improves fertility and tilth of the soil. It includes crop rotation, use of green manure crops and crop residue, fertilization, land leveling, minimum tillage, and other suitable practices.

Soil management is a key factor in successful crop production. Some of the major soil properties to consider in a cropland management program—texture, structure, organic matter content, and toxic salts content (salinity)—and irrigation systems are discussed in the following paragraphs.

Texture.—Soil texture largely determines the amount of water available for plant growth. Coarse textured soils have low available water capacity, and in summer they provide only enough moisture for about 1 week of plant growth between irrigations. The water intake rate generally is high, and the permeability is moderately rapid to rapid. Moderately fine textured and fine textured soils have high available water capacity, and in summer they provide enough moisture for about 2 weeks of plant growth between irrigations. The water intake rate is moderate to slow, and the permeability is moderately slow to very slow. These soils are more susceptible to compaction during tillage than are the coarse textured soils. The moderately coarse textured soils have intermediate properties.

Structure.—The ability of any soil to support plants and the response of the soil to management depend as much on its structure as on its fertility. Soils that have wedge-shaped aggregates have much more pore space between the aggregates for air, water, and root movement than do soils of comparable fertility that are structureless or have coarse blocky structure. Excessive

tillage breaks down soil aggregates and compacts the soils to such a degree that movement of plant roots, water, and air is severely restricted. A plowpan is common. Limiting tillage when the soil is dry reduces breakdown of soil aggregates. Limiting tillage when the soil is wet reduces soil compaction and formation of a plowpan. Chiseling and subsoiling are at best only a temporary solution for disruption of a plowpan. Varying the depth of tillage limits the formation of a plowpan. Eliminating or minimizing equipment and water compaction is necessary for a long term solution.

Organic matter content.—Organic matter tends to increase aggregation, available water capacity, fertility, and microbiological activity of soils and to improve soil tilth. Most of the soils in this survey area are very low in content of organic matter. The hot, dry climate tends to promote loss of organic matter about as fast as it is formed; therefore, it is important to return as much organic matter to the soils as is feasible. It can be barnyard or feedlot manure, crop residue, or green manure crops. Sufficient nitrogen should be added to crop residue to aid decomposition and plant growth.

Toxic salt content (salinity).—The soils on the Colorado River flood plain are saline. The salinity is the result of accumulated salts from alluvial deposits and subsequent evaporation of soil moisture. The rainfall is not sufficient to leach these salts below the plant root zone; therefore, there is a continuing accumulation of salts. These salts are primarily calcium, sodium, magnesium, chloride, and sulfate. An excessive amount of toxic salts in the soil can delay or prevent seed germination, decrease available water capacity, interfere with plant growth, and impede the movement of air and water through the soil. In this survey area, the soils are considered to be saline when the electrical conductivity of the saturation extract is more than 10 millimhos. The most efficient method for leaching excess salts below the root zone is use of controlled, uniform applications of irrigation water in level basins. When reclaiming saline soils, salt tolerant crops should be grown. Applications of irrigation water should not exceed the available water capacity. Excess water should be applied once a year during the irrigation season to keep the salts below the root zone. Depending on the soil texture, the degree of salinity, and the kind and intensity of management; about 3 to 5 years is needed to reduce salinity to a level that has very little, if any, significant effect on plant growth.

Irrigation systems.—The single most limiting factor for crop production is lack of water. To achieve optimum crop yields, soil moisture content should be controlled. Effective control of soil moisture content depends directly on the management of the irrigation system.

Most surface irrigation systems are graded (sloping). Underirrigation restricts root development, slows plant growth, and promotes salt buildup in the root zone. Overirrigation can create a temporary high or perched water table, drown plants, and leach out plant nutrients. Graded irrigation systems are limited to about 65 percent efficiency unless a water reuse (pump-back) system is used.

Level basin irrigation systems provide much better control of application and distribution of water than do graded systems. Properly designed and operated, level basin systems practically eliminate the loss of water soluble fertilizer and moisture from the root zone. Thus, less water is used and yields are increased. Most level basin systems can be operated at more than 80 percent efficiency. Soil moisture should be monitored for scheduling irrigations. Closely monitored and managed water application promotes optimum yields and reduces the cost of irrigation.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in climate and other factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; effective irrigation water management; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use. No class V soils are in this survey area.

Class VI soils have severe limitations that make them generally unsuitable for cultivation. No class VI soils are in this survey area.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. No class VIII soils are in this survey area.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* shows that the chief limitation is climate that is very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The capability classification of each map unit is given in the section "Detailed Soil Map Units." The capability units are not given in this soil survey, but they can be obtained from the local office of the Soil Conservation Service.

Rangeland

Bill Smith, range conservationist, Soil Conservation Service, assisted in preparing this section.

About 55 percent of the survey area is rangeland. Use of the rangeland commonly is restricted to seasonal livestock grazing because the annual precipitation is very low.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or have limited suitability for use as rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter

of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition even though the annual yield may be very low. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Recreation

The soils in this survey area that are used for recreation generally are near or adjacent to watercourses (fig. 11).

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 8 and interpretations for septic tank absorption fields in table 9.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Steep slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Figure 11.—The Colorado River, the lifeblood for the farming operations in the survey area, is also the focal point for recreation. Riprap reduces streambank erosion.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required.

The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface.

The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

David W. Seery, biologist, Soil Conservation Service, prepared this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate

vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

This survey area can be divided into several areas that support distinct habitats for wildlife. These areas are discussed in the following paragraphs.

Desert Mountains.—This area is on mountain slopes. The soils are very shallow to moderately deep, extremely stony and extremely gravelly, and moderately sloping to very steep. They support desertic herbaceous plants and desertic shrubs, trees, and vines. Low precipitation and low available water capacity limit the production of vegetation. Desert bighorn sheep, birds of prey, and small mammals are the main wildlife species in this area.

Desert Uplands.—This area is on fan terraces, alluvial fans, and stream terraces, mainly between the hillslopes and the Colorado River flood plain. The soils are deep and are nearly level to very steep. They support desertic herbaceous plants and desertic shrubs, trees, and vines. Low precipitation limits the production of vegetation. Small rodents use this habitat year round. Other wildlife is transient to the area.

Desert Washes.—This area is in the narrow to somewhat broad washes that drain onto the Colorado River flood plain. The soils are deep, very gravelly or extremely gravelly, and sandy. They are nearly level to gently sloping. The soils support desertic riparian herbaceous plants and desertic riparian shrubs, trees, and vines. Low precipitation limits the production of vegetation. This area is used as travel corridors for desert bighorn sheep, mule deer, and birds.

Desert Riparian Areas.—This area is on the Colorado River flood plain, excluding the areas used as cropland. The soils are deep, nearly level to gently sloping, and strongly saline. They support dense stands of riparian herbaceous plants and riparian shrubs, trees, and vines. A variety of wildlife, mainly birds, use the habitat in this area.

Cropland.—This area is mainly on the Colorado River flood plain. The soils are deep, nearly level, and nonsaline to strongly saline. The main crops grown are cotton, lettuce, alfalfa, melons, wheat, and grain sorghum. Some areas attract many kinds and numbers of wildlife because of the availability of both food and water. Shore birds, ducks, geese, and cranes commonly use this area during winter and migration. Feedlots, drains, and canals in this area also attract many kinds of wildlife.

Wetland.—This area is on the Colorado River flood plain, near the river. The soils are deep, nearly level to gently sloping, and moderately saline. They have a water table that ranges from the surface to a depth of 3 feet. The soils support a dense stand of wetland and riparian plants. The main wildlife present are waterfowl and shore birds.

Open Water.—This area consists of several large ponds and lakes and the Colorado River. Waterfowl are found in this area. The area is also used as a source of drinking water for other wildlife. The Colorado River serves as a major navigational aid for migrating birds.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water

conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps and soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts and sodium affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand or clay in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 9 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the

effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, and large stones.

Excessive seepage because of rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water

table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table , only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a *probable* source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an *improbable* source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 11 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and terraces and diversions.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment.

Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or of salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by toxic substances in the root zone, such as salts or sodium. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, soil reaction, and soil tilth.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 12 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (*1*) and the Unified soil classification system (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. No soils in this survey area are in group A-8.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points)

across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 13 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (up to 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the amount of stable aggregates more than 0.84 millimeters in size.

These are represented idealistically by USDA textural classes. Soils containing rock fragments can occur in any group.

1. Sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 13, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 14 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall is not considered flooding, nor is water in swamps and marshes.

Table 14 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the

extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Cemented pans are cemented or indurated underlying materials within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A *thin* pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A *thick* pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 15 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Flüv*, meaning flood plain sediment, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Torrifluvents (*Torri*, meaning hot and dry, plus *fluvent*, the suborder of the Entisols that formed in flood plain sediment).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Torrifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed (calcareous), hyperthermic Typic Torrifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*4*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*5*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Agualt Series

The Agualt series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation ranges from 2 to 4 inches, and the mean annual air temperature ranges from 72 to 76 degrees F.

These soils are coarse-loamy over sandy or sandy-skeletal, mixed (calcareous), hyperthermic Typic Torrifluvents.

Typical pedon of an Agualt sandy loam in an area or Agualt-Cibola sandy loams, 0 to 1 percent slopes; about 5 miles southwest of Parker; 3,300 feet north and 1,350

feet west of the southeast corner of sec. 19, T. 9 N., R. 20 W.

Ap—0 to 9 inches; light yellowish brown (10YR 6/4) sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; common fine interstitial pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—9 to 15 inches; pale brown (10YR 6/3) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak thin platy structure parting to moderate fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many fine tubular pores; thin strata of sand; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—15 to 28 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; moderate thin platy structure; soft, very friable, slightly sticky and slightly plastic; common fine distinct yellowish red (5YR 5/6) mottles; common fine roots; many fine tubular pores; thin strata of silt and sand; slightly effervescent; mildly alkaline; clear wavy boundary.

2C3—28 to 60 inches; pink (7.5YR 7/4) sand, brown (7.5YR 5/4) moist; single grain; loose; nonsticky and nonplastic; few fine roots; many fine interstitial pores; many thin strata of silt; slightly effervescent; mildly alkaline.

The profile typically has strata of sand and silt 0.5 inch or more in thickness. It is effervescent throughout and has occasional lime filaments below a depth of 24 inches. It ranges from nonsaline to strongly saline.

The A horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry or moist. It is sandy loam or clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. It is loam, silt loam, fine sandy loam, or very fine sandy loam and averages less than 18 percent clay.

The 2C horizon generally has hue of 7.5YR, but ranges to 10YR, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The horizon is sand or loamy sand and is less than 15 percent gravel.

Antho Series

The Antho series consists of deep, well drained, moderately rapidly permeable soils on flood plains and alluvial fans. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation ranges from 2 to 4 inches, and the mean annual air temperature ranges from 72 to 76 degrees F.

These soils are coarse-loamy, mixed (calcareous), hyperthermic Typic Torrifluvents.

Typical pedon of Antho loamy fine sand, 0 to 3 percent slopes; about 1.5 miles north of La Paz Wash; 400 feet north and 400 feet west of the southeast corner of sec. 6, T. 4 N., R. 21 W.

A—0 to 9 inches; very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; weak thick platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many fine tubular pores; 12 percent pebbles; slightly effervescent; moderately alkaline; gradual wavy boundary.

C1—9 to 17 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; 13 percent pebbles; thin strata of silt; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—17 to 21 inches; very pale brown (10YR 7/3) gravelly loamy sand, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine roots; many fine tubular pores; 17 percent pebbles; slightly effervescent; moderately alkaline; gradual wavy boundary.

C3—21 to 27 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; 12 percent pebbles; thin strata of silt and sand; slightly effervescent; moderately alkaline; gradual wavy boundary.

C4—27 to 31 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; 3 percent pebbles; thin strata of silt and sand; strongly effervescent; moderately alkaline; gradual wavy boundary.

C5—31 to 36 inches; very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine tubular pores; 10 percent pebbles; thin strata of silt and sand; slightly effervescent; moderately alkaline; gradual wavy boundary.

C6—36 to 60 inches; very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; many fine tubular pores; 5 percent pebbles; thin strata of silt and sand; strongly effervescent; moderately alkaline.

The control section is 3 to 17 percent pebbles.

The A horizon is very pale brown or light gray.

The C horizon is very pale brown or light yellowish brown. It is sandy loam, gravelly fine sandy loam, or loamy very fine sand and has some thin strata of coarser or finer textured material. The 10- to 40-inch control

section averages more than 50 percent fine and coarser sand.

Carrizo Series

The Carrizo series consists of deep, excessively drained, very rapidly permeable soils on flood plains and alluvial fans. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation ranges from 2 to 4 inches, and the mean annual air temperature ranges from 72 to 76 degrees F.

These soils are sandy-skeletal, mixed, hyperthermic Typic Torriorthents.

Typical pedon of Carrizo extremely gravelly coarse sand, 0 to 3 percent slopes; about 2.5 miles northwest of Parker; 2,000 feet west and 1,800 feet south of the northeast corner of sec. 22, T., 1 N., R. 25 E.

C1—0 to 5 inches; light grayish brown (10YR 6/2) extremely gravelly coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine roots; many coarse interstitial pores; 65 percent pebbles; slightly effervescent; moderately alkaline; clear wavy boundary.

C2—5 to 16 inches; light grayish brown (10YR 6/2) very gravelly coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine roots; many coarse interstitial pores; 55 percent pebbles; thin strata of fine sandy loam and sandy loam; slightly effervescent; moderately alkaline; clear wavy boundary.

C3—16 to 25 inches; light yellowish brown (10YR 6/4) very gravelly coarse sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few fine roots; many coarse interstitial pores; 50 percent pebbles; thin strata of fine sandy loam and sandy loam; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C4—25 to 42 inches; brown (7.5YR 5/4) very gravelly loamy coarse sand, dark brown (7.5YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many coarse interstitial pores; 65 percent pebbles; thin strata of fine sandy loam and sandy loam; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C5—42 to 47 inches; brown (10YR 5/3) very gravelly coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; many coarse interstitial pores; 55 percent pebbles; thin strata of fine sandy loam and sandy loam; slightly effervescent; moderately alkaline; clear wavy boundary.

C6—47 to 60 inches; grayish brown (10YR 5/2) very gravelly coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many coarse interstitial pores; 50 percent pebbles; thin strata of fine sandy loam and sandy loam; slightly effervescent; moderately alkaline.

The C horizon is light grayish brown, light yellowish brown, grayish brown, or brown. It is extremely or very gravelly coarse sand, extremely gravelly or gravelly loamy coarse sand, or extremely gravelly loamy sand that has thin strata of fine sandy loam and sandy loam.

Cherioni Series

The Cherioni series consists of very shallow and shallow, well drained soils on hillslopes. These soils have a silica- and lime-cemented duripan over bedrock. They formed in alluvium and colluvium derived from basalt, andesite, rhyolite, and tuff. Slopes are 25 to 70 percent. The mean annual precipitation ranges from 2 to 4 inches, and the mean annual air temperature ranges from 72 to 76 degrees F.

These soils are loamy-skeletal, mixed, hyperthermic, shallow Typic Durorthids.

Typical pedon of a Cherioni extremely stony sandy loam, in an area of Cherioni-Rock outcrop complex, 25 to 70 percent slopes; about 3 miles southeast of Parker on Black Peak; about 3,000 feet east and 1,800 feet south of the northwest corner of sec. 15, T. 9 N., R. 19 W.

A—0 to 3 inches; light yellowish brown (10YR 6/4) extremely stony sandy loam, dark yellowish brown (10YR 4/4) moist; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common fine interstitial pores; 80 percent basalt stones and cobbles; violently effervescent; moderately alkaline; clear wavy boundary.

Bk—3 to 8 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine tubular pores; 45 percent white (10YR 8/2) lime- and silica-cemented nodules and pan fragments; 25 percent angular pebbles; violently effervescent; strongly alkaline; clear wavy boundary.

2Bgkm—8 to 13 inches; very pale brown (10YR 7/4) silica- and lime-cemented duripan, yellowish brown (10YR 5/4) moist; massive; extremely hard; violently effervescent; strongly alkaline; abrupt wavy boundary.

3R—13 inches; extremely hard basalt.

The A horizon is as much as 55 percent pebble-sized pan fragments and 25 percent pebbles, stones, and cobbles that are dominantly basalt. The control section is 50 to 80 percent coarse fragments. Depth to the duripan ranges from 6 to 20 inches. Depth to bedrock ranges from 8 to 21 inches.

The A horizon has hue of 7.5YR or 10YR, and it has value of 6 or 7 when dry and 4 or 5 when moist. The Bk horizon has hue of 7.5YR or 10YR, value of 6 or 7

when dry and 4 or 5 when moist, and chroma of 4 to 6 when dry and moist. It is extremely gravelly or very gravelly sandy loam or loam.

Chuckawalla Series

The Chuckawalla series consists of deep, well drained, moderately slowly permeable soils on fan terraces. These soils formed in mixed alluvium derived from rhyolite, basalt, granite, andesite, schist, and gneiss. Slopes are 1 to 6 percent. The mean annual precipitation ranges from 2 to 4 inches, and the mean annual air temperature ranges from 72 to 76 degrees F.

These soils are loamy-skeletal, mixed, hyperthermic Typic Haplargids.

Typical pedon of a Chuckawalla extremely gravelly silt loam in an area of Chuckawalla-Gunsight association, 1 to 45 percent slopes; about 3.5 miles northwest of Parker, 1,000 feet west and 600 feet south of the northeast corner of sec. 21, T. 1 N., R. 25 E.

E—0 to 1 inches; light yellowish brown (10YR 6/4) extremely gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine platy structure parting to moderate fine subangular blocky; soft, friable, slightly sticky and slightly plastic; peds are vesicular; 90 percent of the surface is covered with pebbles that have strong desert varnish on the upper part; 25 percent pebbles coated with calcium carbonate on the undersides; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Btk1—1 inch to 3 inches; reddish brown (5YR 5/4) very gravelly loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; 50 percent pebbles and cobbles; common pink (5YR 7/3) silt coatings on pebbles and faces of peds; common thick clay films on faces of peds; few thin weakly cemented layers; few fine roots; strongly saline; strongly effervescent; moderately alkaline; clear smooth boundary.

Btk2—3 to 8 inches; brown (7.5YR 5/4) extremely gravelly sandy clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; 60 percent pebbles and 5 percent cobbles; few fine roots; few thick clay films on faces of peds; few thin weakly cemented layers; strongly saline; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—8 to 13 inches; light brown (7.5YR 6/4) extremely gravelly sandy clay loam, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 60 percent pebbles and 5 percent cobbles; silica and calcium carbonate coatings on undersides of rocks; tongues of Bt material; common thin weakly cemented layers; strongly saline; common soft lime masses; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—13 to 22 inches; light brown (7.5YR 6/4) extremely gravelly sandy clay loam, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 60 percent pebbles and 5 percent cobbles; silica and calcium carbonate coatings on undersides of rock fragments; tongues of Bt material; common thin weakly cemented layers; strongly saline; many soft lime masses; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1—22 to 30 inches; light brown (7.5YR 6/4) extremely gravelly loamy sand, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 75 percent pebbles; common thin weakly cemented layers; strongly saline; many soft lime masses; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—30 to 60 inches; light brown (7.5YR 6/4) extremely gravelly loamy sand, brown (7.5YR 5/4) moist; single grain; loose, nonsticky and nonplastic; 75 percent pebbles; common thin weakly cemented layers; strongly saline; many soft lime masses; strongly effervescent; moderately alkaline.

The electrical conductivity of the saturated extract in the control section ranges from 25 to 40 millimhos. The control section is less than 1 percent organic matter. It is 40 to 85 percent rock fragments that are dominantly 0.5 to 3.0 inches in diameter.

The E horizon is light yellowish brown, light brown, and very pale brown.

The Bt horizon is reddish brown, brown, light brown, pink, or reddish yellow. It is extremely gravelly sandy clay loam, very gravelly loam, or very gravelly clay loam.

The Bk horizon is light brown, reddish yellow, or very pale brown. It is extremely gravelly sandy loam or very gravelly sandy loam.

The C horizon is light brown, pale brown, or very pale brown. It is extremely gravelly loamy sand, extremely gravelly sandy loam, or extremely gravelly loam.

Cibola Series

The Cibola series consists of deep, well drained, moderately slowly permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation ranges from 2 to 4 inches, and the mean annual air temperature ranges from 72 to 76 degrees F.

These soils are fine-silty over sandy-skeletal, mixed (calcareous), hyperthermic Typic Torrifluvents.

Typical pedon of a Cibola sandy loam in an area of Aqualt-Cibola sandy loams, 0 to 1 percent slopes; about 6 miles southwest of Parker; 1,850 feet north and 1,450 feet west of the southeast corner of sec. 19, T. 9 N., R. 20 W.

Ap—0 to 10 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1—10 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate medium platy structure parting to moderate fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many fine tubular pores; thin strata of sand; strongly effervescent; mildly alkaline; gradual smooth boundary.

C2—15 to 20 inches; light yellowish brown (10YR 6/4) silty clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many fine tubular pores; common fine prominent reddish brown (5YR 5/4) mottles; thin strata of sand; violently effervescent; moderately alkaline; clear smooth boundary.

C3—20 to 28 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate thin platy structure; hard, friable, sticky and plastic; common very fine roots; many fine tubular pores; common fine distinct yellowish red (5YR 5/6) mottles; thin strata of sand; violently effervescent; moderately alkaline; clear smooth boundary.

C4—28 to 35 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; moderate thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many fine tubular pores; few thin strata of sand; common fine faint yellowish red (5YR 5/6) mottles; strongly effervescent; mildly alkaline; clear smooth boundary.

2C5—35 to 60 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; few thin strata of silt; many fine interstitial pores; slightly effervescent; mildly alkaline.

Depth to fine sand or sand ranges from 20 to 40 inches. Mottles range from faint to prominent in the lower horizons. The profile ranges from nonsaline to strongly saline. This profile typically has strata of sand and silt 0.5 inch or more in thickness.

The A horizon is pale brown, brown, light yellowish brown, or grayish brown. It is sandy loam or clay loam.

The C horizon is brown, light yellowish brown, very pale brown, light brown, pink, or pinkish gray. It is loam, clay loam, silt loam, or silty clay loam. The 2C horizon is pink or very pale brown. It is fine sand or sand.

Gadsden Series

The Gadsden series consists of deep, well drained, slowly permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 1 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are fine, montmorillonitic (calcareous), hyperthermic Vertic Torrifluvents.

Typical pedon of Gadsden silty clay; about 8 miles south of Poston; 1,350 feet west and 600 feet north of the southeast corner of sec. 18, T. 6 N., R. 21 W.

Ap—0 to 12 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1—12 to 20 inches; pale brown (10YR 6/3) clay, very dark grayish brown (10YR 3/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, very sticky and very plastic; common fine roots; common fine tubular pores; common small pressure faces; thin strata of silt; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—20 to 31 inches; pale brown (10YR 6/3) clay, brown (10YR 4/3) moist; weak very coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; common fine tubular pores; common small pressure faces and few slickensides; thin strata of silt; strongly effervescent; moderately alkaline; clear wavy boundary.

C3—31 to 60 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; common fine tubular pores; thin strata of silt; strongly effervescent; moderately alkaline.

The control section is clay, silty clay, or heavy clay loam and is more than 35 percent clay. The profile ranges from nonsaline to strongly saline. When the soil is dry, cracks 0.25 inch wide or more extend to a depth of 24 inches or more.

The A horizon is brown, reddish gray, pinkish gray, or light reddish brown.

The C horizon is pale brown, light yellowish brown, light reddish brown, reddish brown, or pinkish gray. Thin strata of silt or very fine sandy loam are common.

Gilman Series

The Gilman series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches,

and the mean annual air temperature is 72 to 76 degrees F.

These soils are coarse-loamy, mixed (calcareous), hyperthermic Typic Torrifluvents.

Typical pedon of Gilman fine sandy loam, 0 to 1 percent slopes; about 5 miles southwest of Parker; 2,772 feet north and 264 feet east of the southwest corner of sec. 20, T. 9 N., R. 20 W.

Ap—0 to 10 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; strongly effervescent; mildly alkaline; clear smooth boundary.

C1—10 to 23 inches; light yellowish brown (10YR 6/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; moderate medium platy structure parting to moderate fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; common fine tubular pores; common fine distinct yellowish red (5YR 5/6) mottles; few nodules of rounded silt balls; thin strata of finer textured material; strongly effervescent; mildly alkaline; clear smooth boundary.

C2—23 to 40 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate thick platy structure parting to moderate fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; common fine tubular pores; common fine distinct yellowish red (5YR 5/6) mottles; thin strata of finer textured material; violently effervescent; moderately alkaline; clear smooth boundary.

C3—40 to 60 inches; light yellowish brown (10YR 6/4) very fine sandy loam, dark brown (10YR 4/3) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; few very fine tubular pores; violently effervescent; moderately alkaline.

The profile has strata of fine sand or silty clay loam 0.5 inch to 2.0 inches thick. It ranges from nonsaline to strongly saline.

The A horizon is brown, pale brown, or light yellowish brown. It is fine sandy loam or clay loam.

The C horizon is light yellowish brown, brown, pale brown, or brownish yellow. It is very fine sandy loam, loam, or silt loam and has thin strata of finer textured or slightly coarser textured material.

Glenbar Series

The Glenbar series consists of deep, well drained, moderately slowly permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are fine-silty, mixed (calcareous), hyperthermic Typic Torrifluvents.

Typical pedon of Glenbar silt loam, 0 to 1 percent slopes; about 5 miles south of Parker; 1,600 feet east and 700 feet north of the southwest corner of sec. 35, T. 9 N., R. 20 W.

Ap—0 to 12 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; many fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1—12 to 15 inches; very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) moist; moderate thin platy structure; hard, firm, sticky and plastic; common fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—15 to 26 inches; very pale brown (10YR 7/4) silt loam, dark brown (10YR 4/3) moist; moderate thin platy structure; hard, firm, sticky and plastic; common fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C3—26 to 37 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; moderate thin platy structure; hard, firm, sticky and plastic; few very fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C4—37 to 48 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 4/3) moist; moderate thin platy structure; hard, firm, sticky and plastic; few very fine roots; common fine tubular pores; violently effervescent; moderately alkaline; abrupt wavy boundary.

C5—48 to 60 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; moderate thin platy structure; very hard, firm, sticky and plastic; few very fine roots; few fine tubular pores; violently effervescent; strongly alkaline.

The profile has a layer of sand and silty clay loam 0.5 inch to 2.0 inches thick. Faint mottles are in the lower horizons in some pedons. The profile is nonsaline to strongly saline. The control section is clay loam, silty clay loam, heavy loam, or silt loam.

The A horizon is pale brown, brown, very pale brown, or grayish brown.

The C horizon is very pale brown, light yellowish brown, pale brown, or yellowish brown. It is silt loam, silty clay loam, heavy loam, or clay loam.

Gunsight Series

The Gunsight series consists of deep, well drained, moderately permeable soils on fan terraces and hillslopes. These soils formed in calcareous stratified alluvium derived from mixed sources, including rhyolite, basalt, andesite, schist, and gneiss. Slopes are 1 to 60 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are loamy-skeletal, mixed, hyperthermic Typic Calciorthids.

Typical pedon of a Gunsight very gravelly sandy loam in an area of Chuckawalla-Gunsight-Carrizo association, 1 to 45 percent slopes; about 3 miles northwest of Parker; about 1,000 feet west and 2,100 feet north of the southeast corner of sec. 15, T. 1 N., R. 25 E.

A—0 to 2 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (10YR 4/3) moist; weak medium platy structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine vesicular and tubular pores; 40 percent angular pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

Bw1—2 to 6 inches; pink (7.5YR 7/4) gravelly sandy clay loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; 30 percent pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

Bw2—6 to 12 inches; very pale brown (10YR 7/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; 33 percent pebbles; violently effervescent; strongly alkaline; clear wavy boundary.

Bk1—12 to 19 inches; very pale brown (10YR 8/3) extremely gravelly sandy clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, firm, sticky and slightly plastic; common fine roots; many fine tubular pores; 70 percent weakly cemented pebbles; 29 percent calcium carbonate; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—19 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine interstitial pores; 80 percent lime coated pebbles; violently effervescent; moderately alkaline.

Depth to the calcic horizon ranges from 10 to 14 inches. The control section is 35 to 80 percent rock fragments. The profile is moderately alkaline or strongly alkaline. The calcic horizon is 10 to 30 percent calcium carbonate.

The A horizon is light yellowish brown, brown, light brown, and pale brown.

The Bw horizon is pink, very pale brown, brown, light yellowish brown, or dark yellowish brown. It is gravelly sandy loam, gravelly sandy clay loam, or extremely gravelly sandy clay loam.

The Bk horizon is pale brown, very pale brown, brown, light yellowish brown, or dark yellowish brown. It is extremely gravelly sandy clay loam or extremely gravelly sandy loam.

Holtville Series

The Holtville series consists of deep, well drained, slowly permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are clayey over loamy, montmorillonitic (calcareous), hyperthermic Vertic Torrifluvents.

Typical pedon of a Holtville silty clay loam in an area of Holtville-Kofa complex, 0 to 1 percent slopes; about 6 miles southwest of Parker; 2,900 feet south and 4,620 feet west of the northeast corner of sec. 30, T. 9 N., R. 20 W.

Ak—0 to 7 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; very hard, firm, sticky and plastic; many fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—7 to 17 inches; light reddish brown (5YR 6/3) silty clay, reddish brown (5YR 4/3) moist; moderate thin platy structure; very hard, very firm, very sticky and very plastic; common very fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—17 to 32 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; moderate thin platy structure; extremely hard, very firm, very sticky and very plastic; many very fine roots; common fine tubular pores; common fine distinct reddish brown (5YR 5/4) mottles; common small pressure faces and few slickensides; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C3—32 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; common fine distinct yellowish red (5YR 5/6) mottles; strongly effervescent; moderately alkaline.

The profile is nonsaline to strongly saline. Depth to the 2C horizon ranges from 20 to 40 inches.

The A horizon is brown, dark grayish brown, or pinkish gray.

The C horizon is light reddish brown, pale brown, or very pale brown. It is silty clay loam, silty clay, or clay.

The 2C horizon is very pale brown, light yellowish brown, or pale brown. It is loam, sandy loam, very fine sandy loam, or fine sandy loam.

Kofa Series

The Kofa series consists of deep, well drained, slowly permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are clayey over sandy or sandy-skeletal, montmorillonitic (calcareous), hyperthermic Vertic Torrifluvents.

Typical pedon of a Kofa clay in an area of Holtville-Kofa complex, 0 to 1 percent slopes; about 6 miles southwest of Parker; 900 feet south and 130 feet west of the northeast corner of sec. 30, T. 9 N., R. 20 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) clay, brown (10YR 4/3) moist; weak fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; many fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; abrupt boundary.

C1—10 to 22 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; strong thick platy structure parting to weak fine subangular blocky; extremely hard, very firm, very sticky and very plastic; many fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—22 to 30 inches; grayish brown (10YR 5/2) silty clay, brown (10YR 4/3) moist; weak fine subangular blocky structure; very hard, very firm, sticky and plastic; many fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

2C3—30 to 33 inches; light yellowish brown (10YR 6/4) very fine sandy loam, brown (10YR 4/3) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many fine irregular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

2C4—33 to 60 inches; very pale brown (10YR 7/4) sand, light yellowish brown (10YR 6/4) moist; single grain; loose, nonsticky and nonplastic; few fine roots; many fine irregular pores; slightly effervescent; mildly alkaline.

In some pedons pressure faces and small slickensides are in the C2 or C3 horizons. The profile ranges from nonsaline to strongly saline.

The A horizon is grayish brown or brown.

The C horizon is grayish brown, brown, reddish gray, or light reddish brown. It is clay, silty clay loam, silty clay, or clay loam.

The 2C horizon is very pale brown or light yellowish brown. It is loamy sand, sand, or fine sand below the thin very fine sandy loam transition horizon. Depth to the 2C horizon ranges from 20 to 40 inches.

Lagunita Series

The Lagunita series consists of deep, somewhat excessively drained, rapidly permeable soils on flood plains. These soils formed in coarse textured alluvium. Slopes are 0 to 5 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are mixed hyperthermic Typic Torripsamments.

Typical pedon of Lagunita loamy sand, 0 to 1 percent slopes; about 3 miles southwest of Poston; 2,640 feet east and 264 feet south of the northwest corner of sec. 15, T. 7 N., R. 21 W.

Ap—0 to 8 inches; light yellowish brown (10YR 6/4) loamy sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; many very fine black (10YR 2/1) sand size particles; strongly effervescent; moderately alkaline; clear wavy boundary.

C—8 to 60 inches; very pale brown (10YR 7/4) fine sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; many very fine black (10YR 2/1) sand size particles; strongly effervescent; moderately alkaline.

The profile ranges from nonsaline to strongly saline. The water table is at a depth of 1 to 3 feet in some areas immediately adjacent to the Colorado River.

The A horizon is light yellowish brown or pale brown.

The C horizon is very pale brown or pale brown. It is loamy sand, loamy fine sand, fine sand, or sand.

Lagunita Variant

The Lagunita Variant consists of deep, poorly drained soils on flood plains. These soils formed in coarse textured alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are mixed, hyperthermic Typic Torripsamments.

Typical pedon of Lagunita Variant loamy sand, 0 to 3 percent slopes; about 15 miles southwest of Poston; 4,500 feet west and 1,200 feet north of the southeast corner of sec. 27, T. 4 N., R. 22 W.

A—0 to 6 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; many very fine black (10YR 2/1) sand-sized particles; strongly effervescent; moderately alkaline; clear wavy boundary.

C—6 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; common fine distinct yellowish red (5YR 5/6) mottles; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; many very fine black (10YR 2/1) sand-sized particles; strongly effervescent; moderately alkaline.

The profile ranges from nonsaline to strongly saline. The water table fluctuates from above the surface to 3 feet below the surface during most of the year. Mottles are distinct or prominent.

The A horizon is light yellowish brown or pale brown.

The C horizon is light gray, light brownish gray, or grayish brown. It is loamy sand, fine sand, or sand.

Laposa Series

The Laposa series consists of moderately deep, well drained, moderately rapidly permeable soils on hillslopes. These soils formed in alluvium and colluvium derived from granite, gneiss, schist, andesite, and rhyolite. Slopes are 15 to 75 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are loamy-skeletal, mixed, hyperthermic Typic Camorthids.

Typical pedon of a Laposa extremely gravelly sandy loam in an area of Laposa-Rock outcrop complex, 15 to 75 percent slopes; about 15 miles south of Poston; 3,000 feet east and 3,000 feet south of the northwest corner of sec. 12, T. 4 N., R. 21 W.

A—0 to 3 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine interstitial pores; about 65 percent pebbles; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

Bw—3 to 11 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine interstitial pores; about 60 percent pebbles; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

Bk—11 to 21 inches; light gray (10YR 7/2) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine interstitial pores; about 75 percent pebbles; some lime coatings on undersides of pebbles; violently effervescent; moderately alkaline (pH 8.2); abrupt wavy boundary.

2R—21 inches; hard, slightly fractured granite.

Depth to bedrock ranges from 20 to 35 inches. The profile is 45 to 80 percent rock fragments.

The A horizon is pale brown or light yellowish brown.

The Bw and Bk horizons are pale brown or light gray. They are extremely gravelly sandy loam or very gravelly loam.

Meloland Series

The Meloland series consists of deep, well drained, somewhat slowly permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 1 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are coarse-loamy over clayey, mixed (calcareous), hyperthermic Typic Torrifluvents.

Typical pedon of Meloland sandy loam; about 10 miles southwest of Parker; 1,200 feet west and 1,600 feet south of the northeast corner of sec. 14, T. 8 N., R. 21 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) sandy loam, brown (10YR 4/3) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1—8 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—15 to 17 inches; pale brown (10YR 6/3) sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many fine interstitial pores; strongly effervescent; moderately alkaline; abrupt boundary.

C3—17 to 22 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; common fine faint reddish brown (5YR 5/4) mottles; moderate thick platy structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; common very fine roots; common fine tubular pores; violently effervescent; moderately alkaline; clear wavy boundary.

C4—22 to 30 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; common fine faint reddish brown (5YR 5/4) mottles;

weak thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

2C5—30 to 60 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; common fine faint reddish brown (5YR 5/4) mottles; strong very fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; common fine tubular pores; strongly effervescent; moderately alkaline.

The profile ranges from nonsaline to strongly saline. Depth to the clayey substratum ranges from 20 to 40 inches.

The A horizon is grayish brown, pale brown, or light brownish gray sandy loam or clay loam.

The C horizon is brown, pale brown, or light yellowish brown. It is sandy loam, loam, fine sandy loam, or clay loam.

The 2C horizon is brown, pale brown, light reddish brown, or reddish brown. It is clay, silty clay, or silty clay loam.

Ripley Series

The Ripley series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are coarse-silty over sandy or sandy-skeletal, mixed (calcareous), hyperthermic Typic Torrifluvents.

Typical pedon of Ripley fine sandy loam, 0 to 1 percent slopes; about 3 miles southwest of Parker; 2,650 feet west and 2,300 feet north of the southeast corner of sec. 21, T. 9 N., R. 20 W.

Ap—0 to 10 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; many very fine flakes of mica; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—10 to 16 inches; very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) moist; common fine faint yellowish brown (10YR 5/8) mottles; moderate thin platy structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; many fine roots; many fine tubular pores; many very fine mica flakes; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—16 to 21 inches; light yellowish brown (10YR 6/4) silt loam, brown (10YR 4/3) moist; many fine faint yellowish brown (10YR 5/8) mottles; moderate thin platy structure; hard, firm, sticky and plastic; many fine roots; many fine tubular pores; many very fine mica flakes; strongly effervescent; moderately alkaline; abrupt wavy boundary.

2C3—21 to 27 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many fine interstitial pores; slightly effervescent; moderately alkaline; clear wavy boundary.

2C4—27 to 60 inches; pink (7.5YR 8/4) fine sand, light brown (7.5YR 6/4) moist; single grain; loose, nonsticky and nonplastic; few fine roots; many fine interstitial pores; slightly effervescent; moderately alkaline.

The soil ranges from nonsaline to strongly saline. Depth to the sandy substratum is 20 to 40 inches.

The A horizon is pale brown, very pale brown, or light yellowish brown.

The C horizon is very pale brown, light yellowish brown, or pale brown. It is silt loam, silty clay loam, or very fine sandy loam.

The 2C horizon is pink or very pale brown. It is fine sand or loamy fine sand.

Rositas Series

The Rositas series consists of deep, somewhat excessively drained, rapidly permeable soils on dunes on fan terraces and stream terraces. These soils formed in eolian sand. They are hummocky. Slopes are 3 to 15 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are mixed, hyperthermic Typic Torripsamments.

Typical pedon of a Rositas sand in an area of Superstition-Rositas association, 0 to 15 percent slopes; about 3 miles southwest of Parker; 1,000 feet south and 1,500 feet east of northwest corner of sec. 16, T. 9 N., R. 19 W.

A—0 to 5 inches; pink (7.5YR 7/4) sand, brown (7.5YR 5/4) moist; single grain; loose, nonsticky and nonplastic; common fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C—5 to 60 inches; pink (7.5YR 7/4) sand, brown (7.5YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few fine roots; slightly effervescent; moderately alkaline.

The control section is sand or fine sand. It is slightly effervescent or strongly effervescent. The profile is very pale brown, light brown, or pink throughout.

Superstition Series

The Superstition series consists of deep, somewhat excessively drained, rapidly permeable soils on stream terraces and fan terraces. These soils formed in alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are mixed, hyperthermic Typic Calciorthids.

Typical pedon of a Superstition gravelly loamy fine sand in an area of Superstition-Rositas association, 0 to 15 percent slopes; about 2.5 miles southeast of Parker; 2,500 feet south of the northeast corner of sec. 17, T. 9 N., R. 19 W.

A—0 to 1 inch; light brown (7.5YR 6/4) gravelly loamy fine sand, brown (7.5YR 5/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine interstitial pores; about 20 percent pebbles; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bw1—1 inch to 3 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; weak medium platy structure parting to weak fine subangular blocky; slightly hard, very friable, slightly sticky and nonplastic; violently effervescent; moderately alkaline; clear smooth boundary.

Bw2—3 to 8 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few gypsum filaments; violently effervescent; moderately alkaline; clear smooth boundary.

Bk1—8 to 13 inches; light brown (7.5YR 6/4) loamy sand, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few soft lime masses; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—13 to 24 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common fine nodules of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—24 to 34 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; common medium nodules of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk4—34 to 51 inches; very pale brown (10YR 7/4) loamy sand, light yellowish brown (10YR 6/4) moist; single grain; loose, nonsticky and nonplastic; few fine nodules of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

2C—51 to 60 inches; very pale brown (10YR 7/4) sand, light yellowish brown (10YR 6/4) moist; single grain; loose, nonsticky and nonplastic; strongly effervescent; moderately alkaline.

The depth to the calcic horizon ranges from 12 to 20 inches. The texture of the control section is loamy fine sand or loamy sand.

The A horizon is light brown or very pale brown.

The B horizon is brown, light brown, light yellowish brown, very pale brown, or pink. It is loamy fine sand, loamy sand, or sandy loam.

The C horizon is yellowish brown, light yellowish brown, very pale brown, or pink. It is loamy fine sand, loamy sand, sand, or very gravelly sand.

Torriothents

Torriothents consists of moderately deep and deep, well drained soils on hillslopes. These soils formed in unconsolidated alluvial sediment derived from claystone, siltstone, sandstone, and mixed pebbles. Slope is 20 to 45 percent. Elevation is 400 to 1,000 feet.

Reference pedon of Torriothents, in an area of Badland-Torriothents-Torripsamments complex, 10 to 60 percent slopes; about 500 feet north and 500 feet west of the southeast corner of sec. 28, T. 10 N., R. 19 W.

A1—0 to 10 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many fine interstitial pores; 45 percent pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—10 to 20 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; many fine interstitial pores; 75 percent pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—20 to 32 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; many fine interstitial pores; 80 percent pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIR—32 inches; weathered granite.

The profile is variable in color and texture. It ranges from sand to clay and is 10 to 80 percent rock fragments. Depth to weathered bedrock ranges from 30 to 60 inches or more.

Torripsamments

Torripsamments are deep, somewhat excessively drained soils on hillslopes. These soils formed in unconsolidated alluvial sediment derived from claystone, siltstone, sandstone, and mixed pebbles. Slope is 10 to 30 percent. Elevation is 400 to 1,000 feet.

Reference pedon of Torripsamments, in an area of Badland-Torriorthents-Torripsamments complex, 10 to 60 percent slopes; about 500 feet west and 200 feet north of the southeast corner of sec. 28, T. 10 N., R. 19 W.

C1—0 to 10 inches; very pale brown (10YR 7/4) fine sand, yellowish brown (10YR 5/4) moist; single grain; loose, very friable, nonsticky and nonplastic; few fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2—10 to 60 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grain; loose, very friable, nonsticky and nonplastic; few fine roots; strongly effervescent; moderately alkaline.

Torripsamments are variable in color. Texture is fine sand, sand, or loamy sand.

Vint Series

The Vint series consists of deep, somewhat excessively drained, moderately rapidly permeable soils on flood plains. These soils formed in stratified mixed alluvium. Slopes are 0 to 3 percent. The mean annual precipitation is 2 to 4 inches, and the mean annual air temperature is 72 to 76 degrees F.

These soils are sandy mixed, hyperthermic Typic Torrifluvents.

Typical pedon of Vint sandy loam, 0 to 1 percent slopes; about 10 miles southwest of Parker; 800 feet east and 1,000 feet south of the northwest corner of sec. 15, T. 8 N., R. 21 W.

Ap—0 to 10 inches; light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; few fine roots; many fine interstitial pores; strongly effervescent; mildly alkaline; abrupt smooth boundary.

C1—10 to 13 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—13 to 33 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many fine interstitial pores; thin strata of loam; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C3—33 to 38 inches; light yellowish brown (10YR 6/4) loamy very fine sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; common fine roots; common fine interstitial pores; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C4—38 to 50 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; soft very friable, nonsticky and nonplastic; common fine roots; common fine interstitial pores; thin strata of loam and very fine sandy loam; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C5—50 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; thin strata of loamy fine sand; violently effervescent; moderately alkaline.

The profile is nonsaline to strongly saline. The 10- to 40-inch control section has strata of sand and loam 1 inch to 3 inches thick.

The A horizon is light yellowish brown or very pale brown.

The C horizon is pale brown, light yellowish brown, or pink. It is stratified loamy fine sand, loamy very fine sand, loam, and very fine sandy loam.

Formation of the Soils

Soil is a natural, three-dimensional body on the Earth's surface that is capable of supporting the growth of plants. Its characteristics and qualities have been determined by physical and chemical processes that result from the interaction of five factors—climate, living organisms, time, topography, and parent material. The influence of any one of these factors varies from place to place, but the interaction of all the factors determines the kind of soil that forms (*6*).

During the last 2 million years or so, the soils in this survey area have undergone significant changes. Variations in climate, combinations of living organisms, kinds of rock, topography, and age of land surfaces result in many combinations of the soil forming factors. These combinations control the basic changes that determine the characteristics of the soil. The changes, including removal, transfer, addition, and transformation, depend on physical and chemical processes that are continuously taking place (*3*).

The changes within the soil determine the horizon differentiation in the profile. The age, or maturity, of the soil is determined by the degree of horizon development. Thus, a soil lacking horizon development is a young, or immature, soil. A soil that has well-expressed horizons is an older, or more mature, soil.

The five major soil-forming factors and their influence on the basic soil changes and the development of soils in the Colorado River Indian Reservation are described in this section.

Parent Material

Parent material must be chemically or physically weathered to produce soil material. The kinds of material produced by weathering are determined by the composition and structure of the original rock. Most kinds of rock are a mixture of several minerals. Generally, plant nutrients are released and clay minerals are formed by weathering; however, in rock that is high in content of resistant minerals, such as quartz, little more than mechanical breakdown results from weathering. The elements released influence the soil fertility level, the kinds of plants that grow, soil color, chemical reaction, and various other soil properties that differentiate soil horizons.

The soils in this survey area formed in sediment derived from granite, schist, gneiss, andesite, rhyolite, basalt, and sandstone. The physical properties of the parent material are strongly reflected in some soils. Chuckawalla soils are weakly cemented, which reflects the calcareous mineralogy of the parent material or perhaps additions of calcareous dust.

Climate

Climate affects soil formation through its influence on vegetation, on weathering, and on runoff and erosion. The main climatic factors that affect soil formation are precipitation and temperature.

The climate of this survey area is characterized by hot summers, mild winters, and very little rainfall. Presumably, it is similar to the climate under which most of the soils of the Holocene were formed. The climate is considered to have been cooler and more moist during the Pleistocene.

A hot, dry climate restricts the rate of soil formation. The process of soil formation in alluvium begins when water percolates through it. Translocation of carbonates, humus, iron, manganese, and clay then occurs. Low rainfall delays this leaching and the subsequent development of distinct horizons. Thus, the soils of the flood plains and alluvial fans, such as those of the Antho series, show little if any evidence of illuviation. The very high temperatures in summer contribute to oxidation of the organic matter, and low rainfall results in production of only a small amount of vegetation; therefore, the organic matter content of the soils in this survey area is very low.

Relief

Relief influences runoff and drainage. In general, runoff is greater and less moisture is retained in the steeper areas. Thus, the parent material is less weathered because of less moisture. In some areas the soils erode at about the same rate or at a higher rate than material is weathered from the parent rock. The result is areas of shallow soils or areas where bedrock is at or near the surface. The Cherioni soils are an example of such soils. In less sloping areas, water enters the profile, weathering takes place, nutrients are released, plants grow, and micro-organisms multiply. Soils such as the Chuckawalla soils formed in these areas.

Recent alluvium has been deposited along the Colorado River and the other larger drainageways, and

soils such as those in the Gilman, Glenbar, Kofa, Lagunita, Ripley, and Vint series have formed in these areas.

Plants and Animals

Plants, animals, insects, bacteria, and fungi affect the formation of soils by increasing the organic matter content of the soils, producing gains or losses in plant nutrients, and changing structure and porosity.

In this survey area, most biological effects began after the stratified alluvial deposits were sufficiently drained to support plants and animals. Through the activities of living organisms, the river deposits became more mixed, acquired a more open structure, and developed a heterogeneous pore system that is conducive to still further and stronger biological activity.

Man can also influence soil development. In this survey area, large amounts of soil material have been moved to allow efficient use of irrigation water. The soil forming process must start all over again in areas where the soils have been picked up, mixed, and then replaced. In areas from which the entire soil material has been removed, the soil forming processes must also start over again. How drastic these differences are depends on the stage of development of the original soil. It is obvious that for many years these cut and fill areas will be different from the original soil.

Time

The time available for a soil to form in unconsolidated sediment is the time that has elapsed since the rate of soil development exceeded the rate of deposition of parent material. In general, it takes much more time for the accumulation of parent material than it does for the horizons in the soil to develop. The soils in the survey area that formed in material derived from consolidated sedimentary and igneous rocks began to develop after the parent rock weathered into permeable material.

The unconsolidated sediment was deposited during the late Tertiary and the Quaternary. It ranges in age from middle Pliocene to Recent. Soils such as those in the Chuckawalla series were forming during the Pleistocene. Soils such as those in the Antho, Gadsden, Gilman, Glenbar, Holtville, Kofa, Lagunita, and Vint series are no longer subject to annual flooding because of the dam upstream. They no longer receive surficial deposits, and soil formation in these soils has barely begun.

Geomorphology and Geology

The survey area is characterized by low, northwest trending mountains that are separated by extensive desert plains. The Colorado River has cut through the plains. There are six major landscape positions in the survey area—hillslopes, stream terraces, fan terraces, sand dunes, alluvial fans, and flood plains (fig. 12).

The hillslopes are composed of dense crystalline rock of the pre-Tertiary. Hard volcanic rock forms the higher, more rugged exposures, and less consolidated sedimentary and volcanic rock forms the lower, more rounded hills. Some of the mountains are inundated by alluvium, particularly those in the southern part of the area.

The older fan terraces are characterized by desert pavement and are cut by numerous washes along the flanks of the hillslopes. Along the border of the Colorado River Valley are younger fan terraces. They are distinguishable from the older fan terraces by an absence of desert pavement and by the shallow depth of the cuts made by the most recent washes.

The stream terraces occur at two levels in the survey area. The town of Parker is on the lower terrace. The second terrace, which is about 100 to 400 feet higher, comprises the Cactus Plain. The stream terraces consist of alluvium made up of gravel, sand, and silt and overlain in places by eolian deposits. The eolian sands have resisted weathering; therefore, the terraces are composed mainly of loose and rapidly permeable sandy soils, such as those of the Superstition and Rositas series.

The Colorado River has dominated the geologic history of the area. Faulting and volcanism began in the Mesozoic era. Sedimentation in the Colorado River Valley was probably greatest during the Pleistocene. During this time the mountains of Colorado, Utah, and Wyoming had large alpine glaciers, the melting of which resulted in large amounts of outwash. Also, during this time the precipitation was several times that of the present. The precipitation combined with the glacial outwash caused extensive erosion. The Colorado River transported the resulting sediment, and it has filled the deep trough of the Gulf of California.

The flood plain south of Parker is known as Parker Valley. It is the largest flood plain below the Grand Canyon. At the end of the Pleistocene, the flow of the Colorado River decreased. The river gradually eroded a deep channel into the sedimentary deposits and formed the present flood plain and valley. Before the installation of the dams on the Colorado River, it meandered a great deal during the various floods. Since the installation of dams and levees on the river, however, flooding has been largely confined to Bouse and Tyson Washes during high intensity rainstorms.

The escarpment above the flood plain becomes higher and more broadly dissected from north to south. It consists of Badland, Torriorthents, and Torripsamments.

The ancient geomorphic surfaces that formed during periods of higher rainfall, cooler climate, and more dense plant cover occur as fan terraces. These surfaces occur as dissected fans and ridges that are generally near mountain foot slopes. The soils in these areas commonly have a desert pavement and are considered to be the oldest soils in the survey area. The soils have an argillic

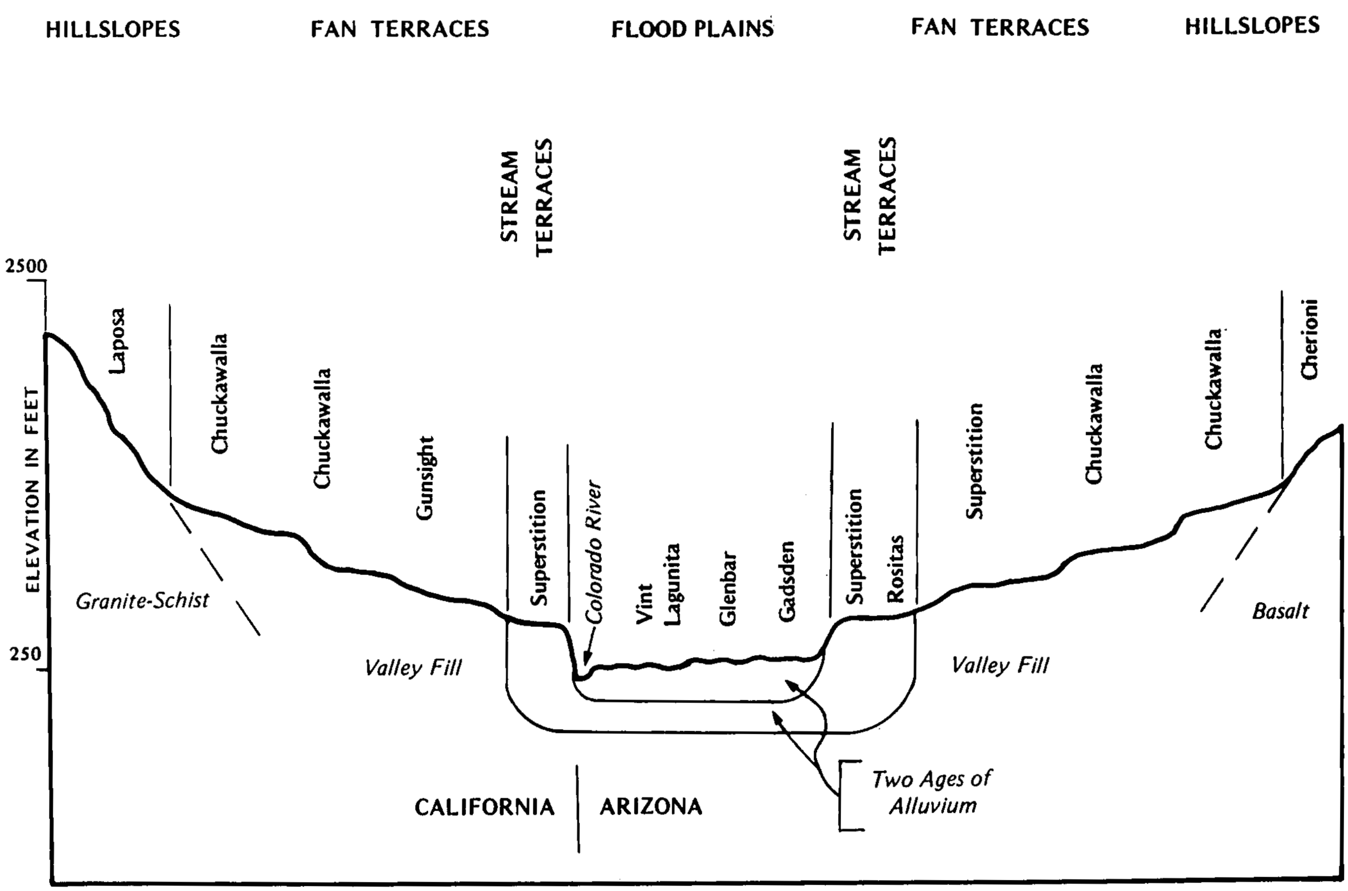


Figure 12.—Soil landscape profile.

horizon and an electrical conductivity of 16 to 40 millimhos in the upper part of the profile. Chuckawalla and Gunsight soils are in these areas.

Laposa soils formed in material derived from granite, gneiss, and schist on mountains. Geologic erosion during the Holocene resulted in the formation of alluvial fans. Carrizo soils formed on these fans, which extend from the mountains to the terraces and flood plains.

Small areas of volcanic rock are throughout the survey area. The largest area occurs as a fringe around the base of the granitic mountains in the northern part of the survey area. The most prominent area is Black Peak, which is southeast of Parker and is known locally as "P" Mountain. The Cherioni soils, Typic Durorthids, are in these areas. They are characterized by a duripan that overlies bedrock.

The soils that formed in flood plain alluvium of varying textures are those of the Agualt, Cibola, Gadsden, Gilman, Glenbar, Holtville, Kofa, Lagunita, Meloland, Ripley, and Vint series.

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Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.5
Low	2.5 to 5.0
Moderate	5.0 to 7.5
High	More than 7.5

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Breaks. The steep to very steep broken land at the border of an upland summit that is dissected by ravines.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter, in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root chanels. Synonyms: clay coating, clay skin.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Desert pavement. A layer of gravel or coarser fragments on a desert soil surface that was emplaced by upward movement of fragments from underlying sediment or remains after finer particles have been removed by running water or wind.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—These soils have very high and high hydraulic conductivity and low water holding capacity. They are not suited to crop production unless irrigated.
Somewhat excessively drained.—These soils have high hydraulic conductivity and low water holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.
Well drained.—These soils have intermediate water holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.
Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless artificial drainage is provided. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.
Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless artificial drainage is provided. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.
Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.
Very poorly drained.—These soils are wet to the surface most of the time. They are wet enough to prevent the growth of important crops (except rice) unless artificially drained.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Hillslope (hillside). The steeper part of a hill between its summit and the drainage line, valley flat or depression floor at the base of the hill.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, or some combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Mountain slope (mountainside). The steeper part of a mountain between its summit and the drainage line, valley flat or depression floor at the base of the mountain.

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color in hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan* and *plowpan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content

of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium. In this survey area, a nonsaline soil has less than 10 millimhos.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soft rock. Rock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream, and it represents the dissected remnants of an abandoned flood plain, streambed, or valley floor produced during a former stage of erosion or deposition.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Summit. A general term for the top, or highest level, of an upland such as a hill, mountain, or table. It usually refers to a high interfluve area of lower slope that is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from

4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Parker, AZ]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	66.8	38.3	52.6	80	23	122	0.60	0.02	1.02	2	0
February---	72.7	42.7	57.7	87	28	232	0.43	---	0.74	1	0
March------	78.3	47.4	62.9	95	32	400	0.47	---	0.81	1	0
April------	86.5	53.6	70.1	103	40	603	0.17	---	0.28	1	0
May--------	95.0	62.4	78.7	110	47	890	0.05	---	0.11	0	0
June-------	104.5	71.2	87.9	118	57	1,137	0.02	---	0.02	0	0
July-------	109.1	79.7	94.4	118	67	1,376	0.26	---	0.47	1	0
August-----	106.8	78.4	92.6	116	65	1,321	0.49	---	0.85	1	0
September--	102.0	70.9	86.5	114	56	1,095	0.40	---	0.69	1	0
October----	91.0	58.5	74.8	105	42	769	0.38	---	0.65	1	0
November---	76.7	45.8	61.3	92	31	339	0.35	0.01	0.59	1	0
December---	67.7	38.6	53.2	81	26	139	0.46	---	0.79	1	0
Yearly:											
Average--	88.1	57.3	72.7	---	---	---	---	---	---	---	---
Extreme--	---	---	---	119	22	---	---	---	---	---	---
Total----	---	---	---	---	---	8,423	4.08	1.95	5.92	11	0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principle crops in the area (40 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-80
at Parker, AZ]

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	February 4	March 2	March 17
2 years in 10 later than--	January 25	February 18	March 6
5 years in 10 later than--	*	January 26	February 12
First freezing temperature in fall:			
1 year in 10 earlier than--	December 26	December 1	November 16
2 years in 10 earlier than--	January 4	December 9	November 23
5 years in 10 earlier than--	*	December 24	December 7

* Probability of occurrence of threshold temperature is less than indicated probability.

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-80
at Parker, AZ. The symbol > means more than]

Probability	Length of growing season if daily minimum temperature exceeds--		
	24 °F	28 °F	32 °F
	Days	Days	Days
9 years in 10	334	286	257
8 years in 10	>365	300	271
5 years in 10	>365	330	298
2 years in 10	>365	>365	325
1 year in 10	>365	>365	339

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	La Paz County	Riverside County	San Bernadino County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Acres	Pct
1	Agualt-Cibola sandy loams, 0 to 1 percent slopes	9,325	260	0	9,585	3.6
2	Agualt-Cibola sandy loams, strongly saline, 0 to 3 percent slopes	3,800	595	90	4,485	1.7
3	Antho loamy fine sand, 0 to 3 percent slopes	830	10	0	840	0.3
4	Badland-Torriorthents-Torripsamments complex, 10 to 60 percent slopes	19,208	541	298	20,047	7.5
5	Carrizo extremely gravelly coarse sand, 0 to 3 percent slopes	6,230	773	2,946	9,949	3.7
6	Cherioni-Rock outcrop complex, 25 to 70 percent slopes	1,236	0	3,292	4,528	1.7
7	Chuckawalla-Gunsight association, 1 to 45 percent slopes	3,378	119	3,722	7,219	2.7
8	Cibola-Agualt clay loams	2,725	85	0	2,810	1.0
9	Gadsden silty clay	3,890	140	0	4,030	1.5
10	Gadsden silty clay, strongly saline	4,332	230	0	4,562	1.7
11	Gilman fine sandy loam, 0 to 1 percent slopes	14,383	731	0	15,114	5.6
12	Gilman fine sandy loam, strongly saline, 0 to 3 percent slopes	8,185	1,455	806	10,446	3.8
13	Gilman clay loam, 0 to 1 percent slopes	5,940	465	0	6,405	2.4
14	Glenbar silt loam, 0 to 1 percent slopes	22,437	120	0	22,557	8.4
15	Glenbar silt loam, strongly saline, 0 to 3 percent slopes	6,875	680	262	7,817	2.9
16	Gunsight very gravelly sandy loam, 15 to 60 percent slopes	6,830	0	8,617	15,447	5.7
17	Gunsight-Chuckawalla-Carrizo association, 1 to 45 percent slopes	0	518	4,717	5,235	1.9
18	Holtville-Kofa complex, 0 to 1 percent slopes	11,153	130	21	11,304	4.2
19	Holtville-Kofa complex, strongly saline, 0 to 3 percent slopes	3,425	840	201	4,466	1.7
20	Lagunita loamy sand, 0 to 1 percent slopes	3,592	595	0	4,187	1.6
21	Lagunita loamy sand, strongly saline, 0 to 5 percent slopes	10,453	895	79	11,427	4.3
22	Lagunita Variant loamy sand, 0 to 3 percent slopes	1,000	715	152	1,867	0.7
23	Laposa-Rock outcrop complex, 15 to 75 percent slopes	14,407	1,854	106	16,367	6.1
24	Meloland sandy loam	1,842	65	0	1,907	0.7
25	Meloland clay loam	532	65	0	597	0.2
26	Ripley fine sandy loam, 0 to 1 percent slopes	1,375	205	0	1,580	0.6
27	Ripley fine sandy loam, strongly saline, 0 to 3 percent slopes	2,647	205	0	2,852	1.1
28	Superstition gravelly loamy fine sand, 0 to 3 percent slopes	6,519	1,409	749	8,677	3.2
29	Superstition-Rositas association, 0 to 15 percent slopes	38,415	0	154	38,569	14.3
30	Vint sandy loam, 0 to 1 percent slopes	6,565	130	0	6,695	2.5
31	Vint sandy loam, strongly saline, 0 to 3 percent slopes	2,205	1,080	110	3,395	1.3
	Water	2,180	1,090	614	3,884	1.4
	Total	225,914	16,000	26,936	268,850	100.0

TABLE 5.--YIELDS PER ACRE OF IRRIGATED CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only the soils suited to irrigated crops are listed]

Soil name and map symbol	Cotton lint	Alfalfa hay	Lettuce[1]	Cantaloupe[2]	Grain sorghum	Wheat	Onions
	Lbs	Tons	Cartons	Crates	Tons	Tons	Sacks
1 Agualt-Cibola	1,020	6.5	1,050	175	1.25	1.5	400
8 Cibola-Agualt	1,200	7.0	1,100	180	1.75	1.75	475
9 Gadsden	1,800	9.0	1,150	185	2.0	2.0	500
11 Gilman	1,200	8.0	1,100	190	1.75	2.25	550
13 Gilman	1,200	8.0	1,100	190	1.75	2.25	550
14 Glenbar	1,920	10.0	1,300	200	2.0	2.25	700
18 Holtville-Kofa	1,800	9.5	1,225	185	2.0	2.0	575
20 Lagunita	360	4.5	950	140	1.0	1.25	360
24 Meloland	1,140	6.0	1,150	180	1.75	2.0	575
25 Meloland	1,200	6.0	1,150	180	1.75	2.0	575
26 Ripley	960	7.0	1,175	180	1.75	2.0	575
28 Superstition	600	6.5	1,075	170	1.25	1.75	390
30 Vint	600	6.0	1,175	165	1.25	1.75	390

1 Includes both spring and fall harvest.
2 Includes honeydew melons.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
2*:					
Agualt	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
Cibola	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
3 Antho	Limy Fan, 2-7" p.z.	Favorable	400	Creosotebush	45
		Normal	200	White bursage	10
		Unfavorable	100	Big galleta	5
				Bush muhly	5
				White ratany	5
4*: Badland.					
Torriorthents	Limy Upland, 2-7" p.z.	Favorable	200	Creosotebush	70
		Normal	100	Bush muhly	5
		Unfavorable	50	Triangle bursage	5
				White bursage	5
				Water ratany	5
Torripsamments	Sandy Upland, 2-7" p.z.	Favorable	800	Big galleta	30
		Normal	500	Primrose	25
		Unfavorable	200	White bursage	10
				Sandverbena	10
				Creosotebush	10
				Fiddleneck	5
5 Carrizo	Sandy Bottom, 2-7" p.z.	Favorable	800	Brittlebush	10
		Normal	500	Burrowbush	10
		Unfavorable	250	Desertthorn	10
				Bush muhly	5
				Big galleta	5
				Dropseed	5
				Blue paloverde	5
				Cactus	5
6*:					
Cherioni	Basalt Hills, 2-7" p.z.	Favorable	700	Triangle bursage	25
		Normal	450	White brittlebush	20
		Unfavorable	300	Creosotebush	10
				Littleleaf paloverde	10
				Ironwood	10
				Cactus	10
				Ocotillo	5
Rock outcrop.					
7*: Chuckawalla.					
Gunsight	Limy Upland, 2-7" p.z.	Favorable	200	Creosotebush	70
		Normal	100	Bush muhly	5
		Unfavorable	50	Triangle bursage	5
				White bursage	5
				White ratany	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
10 Gadsden	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
12 Gilman	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
15 Glenbar	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
16 Gunsight	Limy Upland, 2-7" p.z.	Favorable	200	Creosotebush	70
		Normal	100	Bush muhly	5
		Unfavorable	50	Triangle bursage	5
				White bursage	5
				White ratany	5
17*:					
Gunsight	Limy Upland, 2-7" p.z.	Favorable	200	Creosotebush	70
		Normal	100	Bush muhly	5
		Unfavorable	50	Triangle bursage	5
				White bursage	5
				White ratany	5
Chuckawalla.					
Carrizo	Sandy Bottom, 2-7" p.z.	Favorable	800	Brittlebush	10
		Normal	500	Burrowbush	10
		Unfavorable	200	Desertthorn	10
				Desert ironwood	10
				Bush muhly	5
				Big galleta	5
				Dropseed	5
				Blue paloverde	5
				Desert ironwood	5
				Cactus	5
19*:					
Holtville	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
Kofa	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
21 Lagunita	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
22 Lagunita Variant	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
23*:					
Laposa	Granitic Hills, 2-7" p.z.	Favorable	300	Creosotebush	40
		Normal	200	Ocotillo	25
		Unfavorable	150	White bursage	22
				Littleleaf paloverde	5
Rock outcrop.					
27	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
Ripley		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10
28	Limy Fan (Sandy), 2-7" p.z.	Favorable	750	White bursage	30
Superstition		Normal	500	Big galleta	25
		Unfavorable	300	Creosotebush	15
				Buckhorn cholla	5
29*:					
Superstition	Limy Fan (Sandy), 2-7" p.z.	Favorable	750	White bursage	30
		Normal	500	Big galleta	25
		Unfavorable	300	Creosotebush	15
				Buckhorn cholla	5
Rositas	Sandy Upland, 2-7" p.z.	Favorable	800	Big galleta	30
		Normal	500	Primrose	23
		Unfavorable	200	White bursage	10
				Sandverbena	10
				Creosotebush	6
				Fiddleneck	5
31	Saline Bottom, 2-7" p.z.	Favorable	5,000	Saltcedar	40
Vint		Normal	4,500	Screwbean mesquite	20
		Unfavorable	3,500	Honey mesquite	20
				Arrowweed	10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1*:					
Agualt	Severe: flooding.	Slight	Slight	Slight	Slight.
Cibola	Severe: flooding.	Slight	Slight	Slight	Slight.
2*:					
Agualt	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Slight	Severe: excess salt, droughty.
Cibola	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Slight	Severe: excess salt.
3 Antho	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty.
4*:					
Badland.					
Torriorthents.					
Torripsamments.					
5 Carrizo	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones, droughty.
6*:					
Cherioni	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope, small stones.	Severe: small stones, large stones, droughty.
Rock outcrop.					
7*:					
Chuckawalla	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones, droughty.
Gunsight	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, droughty, slope.
8*:					
Cibola	Severe: flooding.	Slight	Slight	Slight	Slight.
Agualt	Severe: flooding.	Slight	Slight	Slight	Slight.
9 Gadsden	Severe: flooding.	Moderate: too clayey.	Severe: too clayey.	Slight	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
10------------------- Gadsden	Severe: flooding, excess salt.	Severe: excess salt.	Severe: too clayey, excess salt.	Slight----------	Severe: excess salt, droughty, too clayey.
11------------------- Gilman	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
12------------------- Gilman	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Slight----------	Severe: excess salt, droughty.
13------------------- Gilman	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
14------------------- Glenbar	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
15------------------- Glenbar	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Severe: erodes easily.	Severe: excess salt, droughty.
16------------------- Gunsight	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, droughty, slope.
17*:					
Gunsight-------------	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, droughty, slope.
Chuckawalla----------	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones, droughty.
Carrizo--------------	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones, droughty.
18*:					
Holtville------------	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
Kofa-----------------	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
19*:					
Holtville------------	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Slight----------	Severe: excess salt, droughty.
Kofa-----------------	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Moderate: too clayey.	Severe: excess salt, droughty, too clayey.
20------------------- Lagunita	Severe: flooding.	Slight----------	Slight----------	Slight----------	Moderate: droughty.
21------------------- Lagunita	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Slight----------	Severe: excess salt, droughty.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
22: Lagunita Variant	Severe: flooding, wetness, excess salt.	Severe: excess salt.	Severe: wetness, excess salt.	Moderate: wetness.	Severe: excess salt.
23*:					
Laposa	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, large stones, slope.
Rock outcrop.					
24: Meloland	Severe: flooding.	Slight	Slight	Slight	Slight.
25: Meloland	Severe: flooding.	Slight	Slight	Slight	Slight.
26: Ripley	Severe: flooding.	Slight	Slight	Slight	Slight.
27: Ripley	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Slight	Severe: excess salt, droughty.
28: Superstition	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
29*:					
Superstition	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
Rositas	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: too sandy.	Moderate: droughty, slope.
30: Vint	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty.
31: Vint	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Slight	Severe: excess salt, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1*:						
Agualt	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
Cibola	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
2*:						
Agualt	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: excess salt, droughty.
Cibola	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Severe: excess salt, droughty.
3 Antho	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
4*:						
Badland.						
Torriorthents.						
Torripsamments.						
5 Carrizo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, droughty.
6*:						
Cherioni	Severe: depth to rock, cemented pan, slope.	Severe: slope, depth to rock, cemented pan.	Severe: depth to rock, cemented pan, slope.	Severe: slope, depth to rock, cemented pan.	Severe: depth to rock, cemented pan, slope.	Severe: small stones, large stones, droughty.
Rock outcrop.						
7*:						
Chuckawalla	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: small stones, excess salt, droughty.
Gunsight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
8*:						
Cibola	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
Agualt	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
9 Gadsden	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10----------------- Gadsden	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, droughty, too clayey.
11----------------- Gilman	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
12----------------- Gilman	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: excess salt, droughty.
13----------------- Gilman	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
14----------------- Glenbar	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
15----------------- Glenbar	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Severe: excess salt, droughty.
16----------------- Gunsight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
17*:						
Gunsight----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
Chuckawalla------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: small stones, excess salt, droughty.
Carrizo----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, droughty.
18*:						
Holtville--------	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Kofa-------------	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
19*:						
Holtville--------	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, droughty.
Kofa-------------	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, droughty, too clayey.
20----------------- Lagunita	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
21---------------- Lagunita	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: excess salt, droughty.
22---------------- Lagunita Variant	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: excess salt, droughty.
23*:						
Laposa-----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
Rock outcrop.						
24---------------- Meloland	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Moderate: flooding.	Slight.
25---------------- Meloland	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Moderate: flooding.	Slight.
26---------------- Ripley	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding.	Slight.
27---------------- Ripley	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding.	Severe: excess salt, droughty.
28---------------- Superstition	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: small stones, droughty.
29*:						
Superstition-----	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: small stones, droughty.
Rositas----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
30---------------- Vint	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
31---------------- Vint	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: excess salt, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1*:					
Agualt	Severe: poor filter.	Severe: seepage, flooding.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy, small stones.
Cibola	Severe: percs slowly, poor filter.	Severe: seepage, flooding.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy.
2*:					
Agualt	Severe: poor filter.	Severe: seepage, flooding.	Severe: too sandy, excess salt.	Moderate: flooding.	Poor: seepage, too sandy, small stones.
Cibola	Severe: percs slowly, poor filter.	Severe: seepage, flooding.	Severe: too sandy, excess salt.	Moderate: flooding.	Poor: seepage, too sandy.
3 Antho	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding.	Moderate: flooding.	Fair: small stones.
4*:					
Badland.					
Torriorthents.					
Torripsamments.					
5 Carrizo	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy, small stones.
6*:					
Cherioni	Severe: depth to rock, cemented pan, slope.	Severe: depth to rock, cemented pan, slope.	Severe: depth to rock, cemented pan, slope.	Severe: depth to rock, cemented pan, slope.	Poor: area reclaim, slope.
Rock outcrop.					
7*:					
Chuckawalla	Severe: poor filter.	Severe: seepage.	Severe: excess salt.	Slight	Poor: seepage, small stones.
Gunsight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
8*:					
Cibola	Severe: percs slowly, poor filter.	Severe: seepage, flooding.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
8*:					
Agualt	Severe: poor filter.	Severe: seepage, flooding.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy, small stones.
9 Gadsden	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Poor: hard to pack.
10 Gadsden	Severe: percs slowly.	Severe: flooding.	Severe: excess salt.	Moderate: flooding.	Poor: hard to pack.
11 Gilman	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
12 Gilman	Moderate: flooding, percs slowly.	Severe: flooding.	Severe: excess salt.	Moderate: flooding.	Good.
13 Gilman	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
14 Glenbar	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
15 Glenbar	Severe: percs slowly.	Severe: flooding.	Severe: excess salt.	Moderate: flooding.	Good.
16 Gunsight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
17*:					
Gunsight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Chuckawalla	Severe: poor filter.	Severe: seepage.	Severe: excess salt.	Slight	Poor: seepage, small stones.
Carrizo	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy, small stones.
18*:					
Holtville	Moderate: flooding, percs slowly.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
Kofa	Severe: percs slowly, poor filter.	Severe: seepage, flooding.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy.
19*:					
Holtville	Moderate: flooding, percs slowly.	Severe: seepage, flooding.	Severe: excess salt.	Moderate: flooding.	Fair: too sandy.
Kofa	Severe: percs slowly, poor filter.	Severe: seepage, flooding.	Severe: too sandy, excess salt.	Moderate: flooding.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
20: Lagunita	Severe: poor filter.	Severe: seepage, flooding.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy.
21: Lagunita	Severe: poor filter.	Severe: seepage, flooding.	Severe: too sandy, excess salt.	Moderate: flooding.	Poor: seepage, too sandy.
22: Lagunita Variant	Severe: wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: too sandy.	Moderate: flooding, wetness.	Poor: seepage, too sandy.
23*:					
Laposa	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
24, 25: Meloland	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Poor: hard to pack.
26: Ripley	Severe: poor filter.	Severe: seepage, flooding.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy.
27: Ripley	Severe: poor filter.	Severe: seepage, flooding.	Severe: too sandy, excess salt.	Moderate: flooding.	Poor: seepage, too sandy.
28: Superstition	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
29*:					
Superstition	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
Rositas	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy.
30: Vint	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
31: Vint	Moderate: flooding.	Severe: seepage, flooding.	Severe: excess salt.	Moderate: flooding.	Fair: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1*:				
Agualt	Good	Probable	Probable	Poor: small stones, area reclaim.
Cibola	Good	Probable	Improbable: too sandy.	Fair: thin layer.
2*:				
Agualt	Good	Probable	Probable	Poor: small stones, area reclaim, excess salt.
Cibola	Good	Probable	Improbable: too sandy.	Poor: excess salt.
3 Antho	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
4*:				
Badland.				
Torriorthents.				
Torripsamments.				
5 Carrizo	Good	Probable	Probable	Poor: too sandy, small stones.
6*:				
Cherioni	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
7*:				
Chuckawalla	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim, excess salt.
Gunsight	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
8*:				
Cibola	Good	Probable	Improbable: too sandy.	Fair: excess salt.
Agualt	Good	Probable	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
9 Gadsden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
10 Gadsden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
11 Gilman	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
12 Gilman	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
13 Gilman	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
14 Glenbar	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
15 Glenbar	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
16 Gunsight	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
17*:				
Gunsight	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Chuckawalla	Good	Improbable: small stones.	Probable	Poor: small stones, excess salt, area reclaim.
Carrizo	Good	Probable	Probable	
18*:				
Holtville	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Kofa	Good	Probable	Improbable: too sandy.	Poor: too clayey.
19*:				
Holtville	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Kofa	Good	Probable	Improbable: too sandy.	Poor: too clayey, excess salt.
20 Lagunita	Good	Probable	Improbable: too sandy.	Poor: too sandy.
21 Lagunita	Good	Probable	Improbable: too sandy.	Poor: too sandy, excess salt.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
22: Lagunita Variant	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, excess salt.
23*:				
Laposa	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Rock outcrop.				
24: Meloland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
25: Meloland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
26: Ripley	Good	Probable	Improbable: too sandy.	Fair: thin layer.
27: Ripley	Good	Probable	Improbable: too sandy.	Poor: excess salt.
28: Superstition	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
29*:				
Superstition	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Rositas	Good	Probable	Improbable: too sandy.	Poor: too sandy.
30: Vint	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
31: Vint	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions
1*:					
Agualt	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing	Too sandy, soil blowing.
Cibola	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.
2*:					
Agualt	Severe: seepage.	Severe: seepage, excess salt.	Deep to water	Droughty, soil blowing, erodes easily.	Too sandy, soil blowing.
Cibola	Severe: seepage.	Severe: seepage, piping, excess salt.	Deep to water	Droughty, soil blowing, excess salt.	Too sandy, soil blowing.
3 Antho	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing.
4*:					
Badland.					
Torriorthents.					
Torripsamments.					
5 Carrizo	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, fast intake, flooding.	Large stones, too sandy.
6*:					
Cherioni	Severe: depth to rock, cemented pan, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, cemented pan.	Slope, large stones, depth to rock.
Rock outcrop.					
7*:					
Chuckawalla	Severe: seepage.	Severe: seepage, excess salt.	Deep to water	Droughty, slope, excess salt.	Too sandy.
Gunsight	Severe: slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope.
8*:					
Cibola	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable	Too sandy.
Agualt	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy.
9 Gadsden	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions
10----------------- Gadsden	Slight------------	Severe: excess salt.	Deep to water----	Droughty, slow intake, percs slowly.	Percs slowly.
11----------------- Gilman	Moderate: seepage.	Severe: piping.	Deep to water----	Soil blowing-----	Soil blowing.
12----------------- Gilman	Moderate: seepage.	Severe: piping, excess salt.	Deep to water----	Droughty, soil blowing, excess salts.	Soil blowing.
13----------------- Gilman	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable--------	Favorable.
14----------------- Glenbar	Slight------------	Slight------------	Deep to water----	Favorable--------	Favorable.
15----------------- Glenbar	Slight------------	Severe: excess salt.	Deep to water----	Droughty excess salt.	Favorable.
16----------------- Gunsight	Severe: slope.	Severe: seepage.	Deep to water----	Droughty, slope.	Slope.
17*:					
Gunsight----------	Severe: slope.	Severe: seepage.	Deep to water----	Droughty, slope.	Slope.
Chuckawalla------	Severe: seepage.	Severe: seepage, excess salt.	Deep to water----	Droughty, slope, excess salt.	Too sandy.
Carrizo-----------	Severe: seepage.	Severe: seepage.	Deep to water----	Droughty, fast intake, flooding.	Large stones, too sandy.
18*:					
Holtville---------	Severe: seepage.	Severe: piping.	Deep to water----	Percs slowly-----	Favorable.
Kofa--------------	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Slow intake, percs slowly.	Too sandy.
19*:					
Holtville---------	Severe: seepage.	Severe: piping, excess salt.	Deep to water----	Droughty, percs slowly, excess salt.	Favorable.
Kofa--------------	Severe: seepage.	Severe: seepage, piping, excess salt.	Deep to water----	Droughty, slow intake, percs slowly.	Too sandy.
20----------------- Lagunita	Severe: seepage.	Severe: seepage.	Deep to water----	Droughty, fast intake, soil blowing.	Too sandy.
21----------------- Lagunita	Severe: seepage.	Severe: seepage, excess salt.	Deep to water----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
22----------------- Lagunita Variant	Severe: seepage.	Severe: seepage.	Cutbanks cave, excess salt.	Wetness, droughty, fast intake.	Wetness, too sandy.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions
23*:					
Laposa-----------	Severe: slope.	Severe: seepage, large stones.	Deep to water----	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.
Rock outcrop.					
24--------------- Meloland	Moderate: seepage.	Moderate: hard to pack.	Deep to water----	Droughty, percs slowly.	Soil blowing, percs slowly.
25--------------- Meloland	Moderate: seepage.	Moderate: hard to pack.	Deep to water----	Percs slowly-----	Percs slowly.
26--------------- Ripley	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Soil blowing-----	Too sandy, soil blowing.
27--------------- Ripley	Severe: seepage.	Severe: seepage, piping, excess salt.	Deep to water----	Droughty, soil blowing, excess salt.	Too sandy, soil blowing.
28--------------- Superstition	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
29*:					
Superstition-----	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
Rositas----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water----	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.
30--------------- Vint	Severe: seepage.	Severe: piping.	Deep to water----	Soil blowing, fast intake, droughty.	Too sandy, soil blowing.
31--------------- Vint	Severe: seepage.	Severe: piping, excess salt.	Deep to water----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1*:											
Agualt----------	0-9	Sandy loam-------	ML, CL-ML, SM, SM-SC	A-4	0	100	100	70-85	40-55	20-30	NP-10
	9-28	Very fine sandy loam, loam.	CL-ML, ML, SM-SC, SM	A-4	0	100	100	70-85	40-55	20-30	NP-10
	28-60	Sand, gravelly sand, very gravelly sand.	GM, GP-GM, SM, SP-SM	A-1, A-3, A-2	0-15	40-95	30-90	15-60	5-15	---	NP
Cibola----------	0-10	Sandy loam-------	SM, ML	A-4	0	100	95-100	70-85	40-55	25-30	NP-5
	10-35	Silty clay loam, loam, silt loam.	ML	A-6, A-7	0	100	95-100	95-100	85-95	35-50	10-20
	35-60	Fine sand, loamy sand.	SP-SM, SM	A-3, A-2	0	100	95-100	50-80	5-20	---	NP
2*:											
Agualt----------	0-3	Sandy loam-------	ML, CL-ML, SM, SM-SC	A-4	0	100	100	70-85	40-55	20-30	NP-10
	3-28	Loam, silt loam, very fine sandy loam.	CL-ML	A-4	0	100	100	85-95	60-80	25-30	5-10
	28-60	Sand, gravelly sand, very gravelly sand.	GM, GP-GM, SM, SP-SM	A-1, A-2, A-3	0-15	40-95	30-90	15-60	5-15	---	NP
Cibola----------	0-7	Sandy loam-------	SM	A-2, A-4	0	100	95-100	60-70	30-40	20-25	NP-5
	7-35	Silty clay loam, loam, silt loam.	ML	A-6, A-7	0	100	95-100	95-100	85-95	35-50	10-20
	35-60	Fine sand, loamy sand.	SP-SM, SM	A-3, A-2	0	100	95-100	50-80	5-20	---	NP
3---------------- Antho	0-8	Loamy fine sand	SM	A-2	0	100	100	50-80	15-25	---	NP
	8-60	Sandy loam, fine sandy loam, gravelly sandy loam.	SM	A-1, A-2, A-4	0	70-100	65-95	35-60	15-40	15-20	NP-5
4*:											
Badland.											
Torriorthents.											
Torripsamments.											
5---------------- Carrizo	0-5	Extremely gravelly coarse sand.	GP, GM	A-1	0-25	30-65	15-20	10-15	0-5	---	NP
	5-60	Very gravelly coarse sand, very gravelly loamy coarse sand.	GP, GM, SP, SM	A-1	0-25	45-60	35-50	20-35	2-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
6*:											
Cherioni--------	0-3	Extremely stony sandy loam.	GM	A-1, A-2	40-60	35-45	30-40	20-30	10-15	15-20	NP-5
	3-8	Very gravelly very fine sandy loam, extremely gravelly loam, very gravelly sandy loam.	GM, SM, GP-GM, SP-SM	A-1	5-15	30-60	25-50	15-25	5-15	10-25	NP-5
	8-13	Indurated--------	---	---	---	---	---	---	---	---	---
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
7*:											
Chuckawalla-----	0-1	Extremely gravelly silt loam.	GM-GC, GM	A-1, A-2	0-5	30-50	20-25	20-25	15-20	15-25	NP-10
	1-22	Very gravelly loam, extremely gravelly sandy loam.	GM-GC, GM	A-1, A-2	0-5	30-60	20-50	20-40	10-25	25-35	5-10
	22-60	Extremely gravelly loamy sand, extremely gravelly sandy clay loam.	GP-GM	A-1	5-10	20-30	15-25	10-20	5-10	15-25	NP-5
Gunsight--------	0-2	Very gravelly sandy loam.	GM	A-1	0-10	35-55	20-50	15-30	10-20	15-20	NP-5
	2-19	Gravelly sandy clay loam, extremely gravelly sandy clay loam.	GM-GC, SM-SC	A-2, A-1	0-10	35-80	20-75	15-60	5-30	25-30	5-10
	19-60	Very gravelly loam, extremely gravelly sandy loam.	GM, GM-GC	A-1, A-2	0-10	35-55	20-50	20-50	15-30	15-25	NP-10
8*:											
Cibola----------	0-8	Clay loam--------	ML	A-6, A-7	0	100	95-100	95-100	75-95	35-50	10-20
	8-35	Silty clay loam, loam, silt loam.	ML	A-6, A-7	0	100	95-100	95-100	85-95	35-50	10-20
	35-60	Fine sand, loamy sand.	SP-SM, SM	A-3, A-2	0	100	95-100	50-80	5-20	---	NP
Agualt----------	0-9	Clay loam--------	ML, CL	A-6	0	100	100	90-100	70-80	35-40	10-15
	9-28	Loam, silt loam, very fine sandy loam.	CL-ML	A-4	0	100	100	85-95	60-80	25-30	5-10
	28-60	Sand, gravelly sand, very gravelly sand.	GM, GP-GM, SM, SP-SM	A-1, A-3, A-2	0-15	40-95	30-90	15-60	5-15	---	NP
9--------------- Gadsden	0-12	Silty clay-------	CH	A-7	0	100	100	90-100	80-90	50-60	25-35
	12-60	Clay, silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	80-90	50-60	25-35
10-------------- Gadsden	0-7	Silty clay-------	CH	A-7	0	100	100	90-100	80-90	50-60	25-35
	7-60	Clay, silty clay, silty clay loam.	CH	A-7	0	100	100	90-100	80-90	50-60	25-35

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
11---------------- Gilman	0-10	Fine sandy loam	SM	A-4	0	100	95-100	65-85	40-50	15-25	NP-5
	10-60	Loam, silt loam, very fine sandy loam.	CL-ML	A-4	0	100	95-100	80-100	60-85	15-20	5-10
12---------------- Gilman	0-9	Fine sandy loam	SM	A-4	0	100	95-100	65-85	40-50	15-25	NP-5
	9-60	Loam, silt loam, very fine sandy loam.	CL-ML	A-4	0	100	95-100	80-100	60-85	15-20	5-10
13---------------- Gilman	0-13	Clay loam--------	ML, CL	A-6	0	100	95-100	90-100	70-80	35-40	10-15
	13-60	Loam, silt loam, very fine sandy loam.	CL-ML	A-4	0	100	95-100	80-100	60-85	15-20	5-10
14---------------- Glenbar	0-12	Silt loam--------	CL-ML	A-4	0	100	100	95-100	70-80	25-30	5-10
	12-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-7	0	100	100	95-100	75-95	25-40	5-15
15---------------- Glenbar	0-6	Silt loam--------	CL-ML	A-4, A-6	0	100	100	95-100	70-80	25-30	5-10
	6-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-7	0	100	100	95-100	75-95	25-40	5-15
16----------------	0-2	Very gravelly sandy loam.	GM	A-1	0-10	35-55	20-50	15-30	10-20	15-20	NP-5
	2-19	Gravelly sandy loam, extremely gravelly sandy clay loam.	GM-GC, SM-SC	A-2, A-1	0-10	35-80	20-75	15-60	5-30	25-30	5-10
	19-60	Very gravelly loam, extremely gravelly sandy loam.	GM, GM-GC	A-1, A-2	0-10	35-55	20-50	20-50	15-30	15-25	NP-10
17*:											
Gunsight--------	0-2	Very gravelly sandy loam.	GM	A-1	0-10	35-55	20-50	15-30	10-20	15-20	NP-5
	2-19	Gravelly loam, extremely gravelly sandy clay loam.	GM-GC	A-2, A-1	0-10	35-80	20-75	15-60	5-30	25-30	5-10
	19-60	Very gravelly loam, extremely gravelly sandy loam.	GM, GM-GC	A-1, A-2	0-10	35-55	20-50	20-50	15-30	15-25	NP-10
Chuckawalla-----	0-1	Extremely gravelly silt loam.	GM-GC, GM	A-1, A-2	0-5	30-50	20-25	20-25	15-20	15-25	NP-10
	1-22	Very gravelly loam, extremely gravelly sandy clay loam.	GM-GC, GM	A-1, A-2	0-5	30-60	20-50	20-40	10-25	25-35	5-10
	22-60	Extremely gravelly loamy sand, extremely gravelly sandy clay loam.	GP-GM	A-1	5-10	20-30	15-25	10-20	5-10	15-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17*:											
Carrizo---------	0-5	Extremely gravelly coarse sand.	GP, GM,	A-1	0-25	30-65	15-20	10-15	0-5	---	NP
	5-60	Very gravelly coarse sand, very gravelly loamy coarse sand.	GP, GM, SP, SM	A-1	0-25	45-60	35-50	20-35	2-10	---	NP
18*:											
Holtville-------	0-7	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	85-95	40-45	10-20
	7-32	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	32-60	Silt loam, very fine sandy loam, loam.	CL-ML	A-4	0	100	100	95-100	65-85	15-30	5-10
Kofa------------	0-10	Clay-------------	CH	A-7	0	100	100	95-100	85-95	55-75	35-50
	10-30	Clay, silty clay	CH	A-7	0	100	100	95-100	85-95	55-75	35-50
	30-33	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-100	50-65	15-20	NP-10
	33-60	Sand, loamy sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	100	60-80	5-25	---	NP
19*:											
Holtville-------	0-9	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-95	40-45	10-20
	9-32	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	32-60	Silt loam, very fine sandy loam, loam.	CL-ML	A-4	0	100	100	95-100	65-85	15-30	5-10
Kofa------------	0-5	Clay-------------	CH	A-7	0	100	100	95-100	85-95	55-75	35-50
	5-30	Clay, silty clay	CH	A-7	0	100	100	95-100	85-95	55-75	35-50
	30-33	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-100	50-65	15-20	NP-10
	33-60	Sand, loamy sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	100	60-80	5-25	---	NP
20--------------- Lagunita	0-8	Loamy sand-------	SM	A-1, A-2	0	95-100	80-90	45-65	15-30	---	NP
	8-60	Loamy sand, sand, fine sand.	SP-SM, SM	A-1	0	75-90	75-85	40-50	5-20	---	NP
21--------------- Lagunita	0-7	Loamy sand-------	SM	A-2	0	100	100	50-75	15-20	---	NP
	7-60	Loamy sand, sand, fine sand.	SP-SM, SM	A-1	0	75-90	75-85	40-50	5-20	---	NP
22--------------- Lagunita Variant	0-6	Loamy sand-------	SM	A-1, A-2	0	95-100	80-90	40-65	15-30	---	NP
	6-60	Loamy sand, sand, fine sand.	SP-SM, SM	A-1	0	75-90	75-85	40-50	5-20	---	NP
23*:											
Laposa----------	0-3	Extremely gravelly sandy loam.	GM, SM	A-1	15-40	40-65	30-45	20-30	10-20	20-25	NP-5
	3-21	Extremely gravelly sandy loam.	GM, SM	A-1	15-40	40-65	30-45	20-30	10-20	15-20	NP-5
	21	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
24--------------- Meloland	0-8	Sandy loam-------	SM	A-4	0	95-100	90-100	80-100	35-50	20-30	NP-5
	8-30	Stratified sandy loam to clay loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	30-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
25--------------- Meloland	0-10	Clay loam--------	ML, CL	A-6, A-7	0	100	100	90-100	70-80	35-45	10-20
	10-30	Stratified sandy loam to clay loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	30-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
26--------------- Ripley	0-10	Fine sandy loam	SM, SM-SC	A-4	0	100	100	75-85	35-45	20-30	NP-10
	10-21	Silt, silt loam, very fine sandy loam.	CL-ML, ML	A-4	0	100	100	95-100	80-90	20-35	5-10
	21-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2	0	100	100	50-80	10-20	---	NP
27--------------- Ripley	0-8	Fine sandy loam	SM	A-4	0	100	100	75-85	35-50	20-25	NP-5
	8-21	Silt, silt loam, very fine sandy loam.	CL-ML, ML	A-4	0	100	100	95-100	80-90	20-35	5-10
	21-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2	0	100	100	50-80	10-20	---	NP
28--------------- Superstition	0-1	Gravelly loamy fine sand.	SM	A-1	0	70-85	65-75	30-50	10-20	---	NP
	1-60	Loamy fine sand, loamy sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
29*:											
Superstition----	0-1	Gravelly loamy fine sand.	SM	A-1	0	70-85	65-75	30-50	10-20	---	NP
	1-60	Loamy fine sand, loamy sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
Rositas---------	0-8	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	100	80-100	40-80	5-25	---	NP
	8-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
30--------------- Vint	0-10	Sandy loam-------	SM	A-2, A-4	0	100	100	60-70	30-40	15-20	NP-5
	10-60	Stratified loamy fine sand to very fine sandy loam.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
31--------------- Vint	0-10	Sandy loam-------	SM	A-2, A-4	0	100	100	60-75	30-40	20-25	NP-5
	10-60	Stratified loamy fine sand to very fine sandy loam.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
1*:											
Agualt----------	0-9	15-20	0.6-2.0	0.13-0.18	7.9-8.4	<10	Low-------	0.24	5	3	.5-.8
	9-28	15-25	0.6-2.0	0.13-0.18	7.9-8.4	<10	Low-------	0.32			
	28-60	2-5	6.0-20	0.05-0.07	7.9-8.4	<10	Low-------	0.05			
Cibola----------	0-10	10-20	0.6-2.0	0.10-0.14	7.9-8.4	<10	Low-------	0.24	5	3	<.5
	10-35	25-35	0.2-0.6	0.12-0.18	7.9-8.4	<10	Moderate	0.43			
	35-60	0-5	6.0-20	0.04-0.06	7.9-8.4	<10	Low-------	0.10			
2*:											
Agualt----------	0-3	15-20	0.6-2.0	0.01-0.03	7.9-8.4	>10	Low-------	0.24	5	3	.5-.8
	3-28	10-18	0.6-2.0	0.03-0.06	7.9-8.4	>10	Low-------	0.49			
	28-60	2-5	6.0-20	0.01-0.02	7.9-8.4	>10	Low-------	0.05			
Cibola----------	0-7	5-15	2.0-6.0	0.11-0.13	7.9-8.4	>10	Low-------	0.24	5	3	<.5
	7-35	25-35	0.2-0.6	0.12-0.18	7.9-8.4	>10	Moderate	0.43			
	35-60	0-5	6.0-20	0.04-0.06	7.9-8.4	>10	Low-------	0.10			
3---------------- Antho	0-8	3-5	2.0-6.0	0.09-0.11	7.9-8.4	<4	Low-------	0.10	5	2	<.5
	8-60	5-15	2.0-6.0	0.08-0.12	7.9-8.4	<4	Low-------	0.20			
4*:											
Badland.											
Torriorthents.											
Torripsamments.											
5---------------- Carrizo	0-5	0-5	>20	0.03-0.04	7.9-8.4	<4	Low-------	0.02	5	8	<.5
	5-60	2-5	>20	0.03-0.05	7.9-8.4	<4	Low-------	0.05			
6*:											
Cherioni--------	0-3	10-15	2.0-6.0	0.03-0.05	7.9-8.4	<4	Low-------	0.05	1	8	<1
	3-8	10-20	0.6-2.0	0.05-0.07	7.9-8.4	<4	Low-------	0.10			
	8-13	---	---	---	---	---	----------	----			
	13	---	---	---	---	---	----------	----			
Rock outcrop.											
7*:											
Chuckawalla-----	0-1	10-20	0.6-2.0	0.05-0.10	7.9-9.0	<2	Low-------	0.05	5	8	<.5
	1-22	20-30	0.2-0.6	0.03-0.04	7.9-9.0	>16	Low-------	0.05			
	22-60	3-10	6.0-20	0.02-0.05	7.9-9.0	>16	Low-------	0.05			
Gunsight--------	0-2	10-15	2.0-6.0	0.03-0.08	7.9-8.4	2-4	Low-------	0.10	5	8	<.5
	2-19	20-25	0.6-2.0	0.04-0.12	7.9-9.0	2-4	Low-------	0.10			
	19-60	10-20	0.6-2.0	0.04-0.10	7.9-8.4	2-4	Low-------	0.10			
8*:											
Cibola----------	0-8	27-35	0.2-0.6	0.12-0.18	7.9-8.4	<10	Moderate	0.32	5	8	<.5
	8-35	25-35	0.2-0.6	0.12-0.18	7.9-8.4	<10	Moderate	0.43			
	35-60	0-5	6.0-20	0.04-0.06	7.9-8.4	<10	Low-------	0.10			
Agualt----------	0-9	30-35	0.2-0.6	0.19-0.21	7.9-8.4	<10	Moderate	0.32	5	8	<1
	9-28	10-18	0.6-2.0	0.15-0.21	7.9-8.4	<10	Low-------	0.49			
	28-60	2-5	6.0-20	0.05-0.07	7.9-8.4	<10	Low-------	0.05			
9---------------- Gadsden	0-12	50-55	0.06-0.2	0.15-0.17	7.9-8.4	<10	High------	0.32	5	8	<1
	12-60	50-55	0.06-0.2	0.15-0.17	7.9-8.4	<10	High------	0.32			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
10-------------- Gadsden	0-7	50-55	0.06-0.2	0.02-0.05	7.9-8.4	>10	High------	0.32	5	8	<1
	7-60	50-55	0.06-0.2	0.02-0.05	7.9-8.4	>10	High------	0.32			
11-------------- Gilman	0-10	10-20	0.6-2.0	0.13-0.15	7.9-8.4	<10	Low-------	0.28	5	3	<.5
	10-60	10-15	0.6-2.0	0.16-0.18	7.9-8.4	<10	Low-------	0.55			
12-------------- Gilman	0-9	10-20	0.6-2.0	0.02-0.04	7.9-8.4	>10	Low-------	0.28	5	3	<.5
	9-60	10-15	0.6-2.0	0.03-0.06	7.9-8.4	>10	Low-------	0.55			
13-------------- Gilman	0-13	30-35	0.2-0.6	0.19-0.21	7.9-8.4	<10	Moderate	0.32	5	8	<.5
	13-60	10-15	0.6-2.0	0.16-0.18	7.9-8.4	<10	Low-------	0.55			
14-------------- Glenbar	0-12	20-27	0.6-2.0	0.16-0.18	7.9-8.4	<10	Low-------	0.43	5	8	<.5
	12-60	18-35	0.2-0.6	0.19-0.21	7.9-8.4	<10	Moderate	0.37			
15-------------- Glenbar	0-6	20-27	0.6-2.0	0.03-0.06	7.9-8.4	>10	Low-------	0.43	5	8	<.5
	6-60	18-35	0.2-0.6	0.03-0.05	7.9-8.4	>10	Moderate	0.37			
16-------------- Gunsight	0-2	10-15	2.0-6.0	0.03-0.08	7.9-8.4	2-4	Low-------	0.10	5	8	<.5
	2-19	20-25	0.6-2.0	0.04-0.12	7.9-9.0	2-4	Low-------	0.10			
	19-60	10-20	0.6-2.0	0.04-0.10	7.9-8.4	2-4	Low-------	0.10			
17*:											
Gunsight--------	0-2	10-15	2.0-6.0	0.03-0.08	7.9-8.4	2-4	Low-------	0.10	5	8	<.5
	2-19	20-25	0.6-2.0	0.04-0.12	7.9-9.0	2-4	Low-------	0.10			
	19-60	10-20	0.6-2.0	0.04-0.10	7.9-8.4	2-4	Low-------	0.10			
Chuckawalla-----	0-1	10-20	0.6-2.0	0.05-0.10	7.9-9.0	<2	Low-------	0.05	5	8	<.5
	1-22	25-30	0.2-0.6	0.03-0.04	7.9-9.0	>16	Low-------	0.05			
	22-60	3-10	6.0-20	0.02-0.05	7.9-9.0	>16	Low-------	0.05			
Carrizo---------	0-5	0-5	>20	0.03-0.04	7.9-8.4	<4	Low-------	0.02	5	8	<.5
	5-60	2-5	>20	0.03-0.05	7.9-8.4	<4	Low-------	0.05			
18*:											
Holtville-------	0-7	35-40	0.06-0.2	0.16-0.18	7.4-9.0	<10	High------	0.32	5	8	<1
	7-32	40-50	0.06-0.2	0.14-0.16	7.4-9.0	<10	High------	0.32			
	32-60	10-25	0.6-2.0	0.15-0.18	7.4-9.0	<10	Low-------	0.43			
Kofa------------	0-10	50-55	0.06-0.2	0.14-0.16	7.9-8.4	<10	High------	0.32	5	8	.5-1
	10-30	50-55	0.06-0.2	0.14-0.16	7.9-8.4	<10	High------	0.32			
	30-33	10-15	0.6-2.0	0.15-0.17	7.9-8.4	<10	Low-------	0.37			
	33-60	5-10	6.0-20.0	0.04-0.07	7.9-8.4	<10	Low-------	0.10			
19*:											
Holtville-------	0-9	30-40	0.2-0.6	0.02-0.05	7.9-9.0	>10	Moderate	0.32	5	8	<1
	9-32	40-50	0.06-0.2	0.01-0.04	7.9-9.0	>10	High------	0.32			
	32-60	10-25	0.6-2.0	0.01-0.05	7.9-9.0	>10	Low-------	0.43			
Kofa------------	0-5	50-55	0.06-0.2	0.03-0.04	7.9-8.4	>10	High------	0.32	5	6	.5-1
	5-30	50-55	0.06-0.2	0.03-0.05	7.9-8.4	>10	High------	0.32			
	30-33	10-15	0.6-2.0	0.04-0.05	7.9-8.4	>10	Low-------	0.37			
	33-60	5-10	6.0-20	0.01-0.02	7.9-8.4	>10	Low-------	0.10			
20-------------- Lagunita	0-8	0-5	6.0-20.0	0.04-0.07	7.9-8.4	<10	Low-------	0.10	5	1	<.5
	8-60	0-5	6.0-20.0	0.03-0.06	7.9-8.4	<10	Low-------	0.10			
21-------------- Lagunita	0-7	0-5	6.0-20	0.03-0.05	8.5-9.0	>10	Low-------	0.10	5	1	<.5
	7-60	0-5	6.0-20	0.02-0.04	8.5-9.0	>10	Low-------	0.10			
22-------------- Lagunita Variant	0-6	0-5	6.0-20	0.03-0.05	7.9-8.4	8-16	Low-------	0.10	5	1	<.5
	6-60	0-5	6.0-20	0.02-0.05	7.9-8.4	8-16	Low-------	0.10			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
23*:											
Laposa----------	0-3	10-15	2.0-6.0	0.04-0.05	7.9-8.4	<2	Low-------	0.05	2	8	<.5
	3-21	10-15	2.0-6.0	0.04-0.05	7.9-8.4	<2	Low-------	0.05			
	21	---	---	---	---	---	----------	----			
Rock outcrop.											
24--------------- Meloland	0-8	8-18	0.6-2.0	0.10-0.12	7.4-8.4	<10	Low-------	0.24	5	3	<1
	8-30	8-18	0.6-2.0	0.12-0.16	7.4-8.4	<10	Low-------	0.43			
	30-60	35-55	0.06-0.2	0.13-0.15	7.4-8.4	<10	High------	0.32			
25--------------- Meloland	0-10	30-40	0.2-0.6	0.12-0.16	7.9-8.4	<10	Moderate	0.32	5	8	<1
	10-30	8-18	0.6-2.0	0.12-0.16	7.9-8.4	<10	Low-------	0.43			
	30-60	35-55	0.06-0.2	0.13-0.15	7.9-8.4	<10	High------	0.32			
26--------------- Ripley	0-10	10-20	0.6-2.0	0.13-0.15	7.9-8.4	<10	Low-------	0.28	5	3	<.5
	10-21	5-18	0.6-2.0	0.11-0.14	7.9-8.4	<10	Low-------	0.43			
	21-60	5-10	6.0-20	0.05-0.07	7.9-8.4	<10	Low-------	0.20			
27--------------- Ripley	0-8	10-20	0.6-2.0	0.03-0.04	7.9-8.4	>10	Low-------	0.28	5	3	<.5
	8-21	5-18	0.6-2.0	0.04-0.06	7.9-8.4	>10	Low-------	0.43			
	21-60	5-10	6.0-20	0.01-0.02	7.9-8.4	>10	Low-------	0.20			
28--------------- Superstition	0-1	3-5	6.0-20	0.07-0.09	7.9-8.4	<2	Low-------	0.10	5	1	<.5
	1-60	0-5	6.0-20	0.05-0.11	7.9-8.4	<4	Low-------	0.15			
29*:											
Superstition----	0-1	3-5	6.0-20	0.07-0.09	7.9-8.4	<2	Low-------	0.10	5	1	<.5
	1-60	0-5	6.0-20	0.05-0.11	7.9-8.4	<4	Low-------	0.15			
Rositas---------	0-8	0-5	6.0-20	0.04-0.05	7.9-8.4	2-4	Low-------	0.20	5	1	<.5
	8-60	0-5	6.0-20	0.04-0.05	7.9-8.4	2-4	Low-------	0.20			
30--------------- Vint	0-10	10-15	2.0-6.0	0.10-0.12	7.9-8.4	<10	Low-------	0.20	5	3	<.5
	10-60	5-10	2.0-6.0	0.09-0.11	7.9-8.4	<10	Low-------	0.10			
31--------------- Vint	0-10	10-15	2.0-6.0	0.02-0.03	7.9-8.4	>10	Low-------	0.20	5	3	<.5
	10-60	5-10	2.0-6.0	0.01-0.03	7.9-8.4	>10	Low-------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SOIL AND WATER FEATURES

["Flooding" and terms such as "rare" and "very brief" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Thickness	Uncoated steel	Concrete
					In		In			
1*:										
Agualt-----------	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
Cibola-----------	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
2*:										
Agualt-----------	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
Cibola-----------	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
3----------------- Antho	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
4*:										
Badland.										
Torriorthents.										
Torripsamments.										
5----------------- Carrizo	A	Occasional	Very brief	Jun-Oct	>60	---	---	---	High-----	Low.
6*:										
Cherioni---------	D	None---------	---	---	8-21	Hard	6-20	Thick	High-----	Low.
Rock outcrop.										
7*:										
Chuckawalla------	B	None---------	---	---	>60	---	---	---	High-----	Moderate.
Gunsight---------	B	None---------	---	---	>60	---	---	---	High-----	Moderate.
8*:										
Cibola-----------	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
Agualt-----------	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
9----------------- Gadsden	D	Rare---------	---	---	>60	---	---	---	High-----	Low.
10---------------- Gadsden	D	Rare---------	---	---	>60	---	---	---	High-----	Moderate.
11---------------- Gilman	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
12---------------- Gilman	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
13---------------- Gilman	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
14---------------- Glenbar	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
15---------------- Glenbar	B	Rare---------	---	---	>60	---	---	---	High-----	Low.
16---------------- Gunsight	B	None---------	---	---	>60	---	---	---	High-----	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	Bedrock: Depth	Bedrock: Hardness	Cemented pan: Depth	Cemented pan: Thick-ness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					In		In			
17*:										
Gunsight	B	None	---	---	>60	---	---	---	High	Low.
Chuckawalla	B	None	---	---	>60	---	---	---	High	Moderate.
Carrizo	A	Occasional	Very brief	Jun-Oct	>60	---	---	---	High	Low.
18*:										
Holtville	C	Rare	---	---	>60	---	---	---	High	Low.
Kofa	D	Rare	---	---	>60	---	---	---	High	Low.
19*:										
Holtville	C	Rare	---	---	>60	---	---	---	High	Low.
Kofa	D	Rare	---	---	>60	---	---	---	High	Low.
20 Lagunita	A	Rare	---	---	>60	---	---	---	High	Low.
21 Lagunita	A	Rare	---	---	>60	---	---	---	High	Moderate.
22 Lagunita Variant	C	Rare	---	---	>60	---	---	---	High	Low.
23*:										
Laposa	C	None	---	---	20-35	Hard	---	---	High	Low.
Rock outcrop.										
24 Meloland	C	Rare	---	---	>60	---	---	---	High	Low.
25 Meloland	C	Rare	---	---	>60	---	---	---	High	Low.
26 Ripley	B	Rare	---	---	>60	---	---	---	High	Low.
27 Ripley	B	Rare	---	---	>60	---	---	---	High	Low.
28 Superstition	A	None	---	---	>60	---	---	---	High	Low.
29*:										
Superstition	A	None	---	---	>60	---	---	---	High	Low.
Rositas	A	None	---	---	>60	---	---	---	High	Low.
30 Vint	B	Rare	---	---	>60	---	---	---	High	Low.
31 Vint	B	Rare	---	---	>60	---	---	---	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Agualt	Coarse-loamy over sandy or sandy-skeletal, mixed (calcareous), hyperthermic Typic Torrifluvents
Antho	Coarse-loamy, mixed (calcareous), hyperthermic Typic Torrifluvents
Carrizo	Sandy-skeletal, mixed, hyperthermic Typic Torriorthents
Cherioni	Loamy-skeletal, mixed, hyperthermic, shallow Typic Durorthids
Chuckawalla	Loamy-skeletal, mixed, hyperthermic Typic Haplargids
Cibola	Fine-silty over sandy or sandy-skeletal, mixed (calcareous), hyperthermic Typic Torrifluvents
Gadsden	Fine, montmorillonitic (calcareous), hyperthermic Vertic Torrifluvents
Gilman	Coarse-loamy, mixed (calcareous), hyperthermic Typic Torrifluvents
Glenbar	Fine-silty, mixed (calcareous), hyperthermic Typic Torrifluvents
Gunsight	Loamy-skeletal, mixed, hyperthermic Typic Calciorthids
Holtville	Clayey over loamy, montmorillonitic (calcareous), hyperthermic Vertic Torrifluvents
Kofa	Clayey over sandy or sandy-skeletal (calcareous), hyperthermic Vertic Torrifluvents
Lagunita	Mixed, hyperthermic Typic Torripsamments
Lagunita Variant	Mixed, hyperthermic Typic Torripsamments
Laposa	Loamy-skeletal, mixed, hyperthermic Typic Camborthids
Meloland	Coarse-loamy over clayey, mixed (calcareous), hyperthermic Typic Torrifluvents
Ripley	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), hyperthermic Typic Torrifluvents
Rositas	Mixed, hyperthermic Typic Torripsamments
Superstition	Sandy, mixed, hyperthermic Typic Calciorthids
Torriorthents	Torriorthents
Torripsamments	Torripsamments
Vint	Sandy, mixed, hyperthermic Typic Torrifluvents

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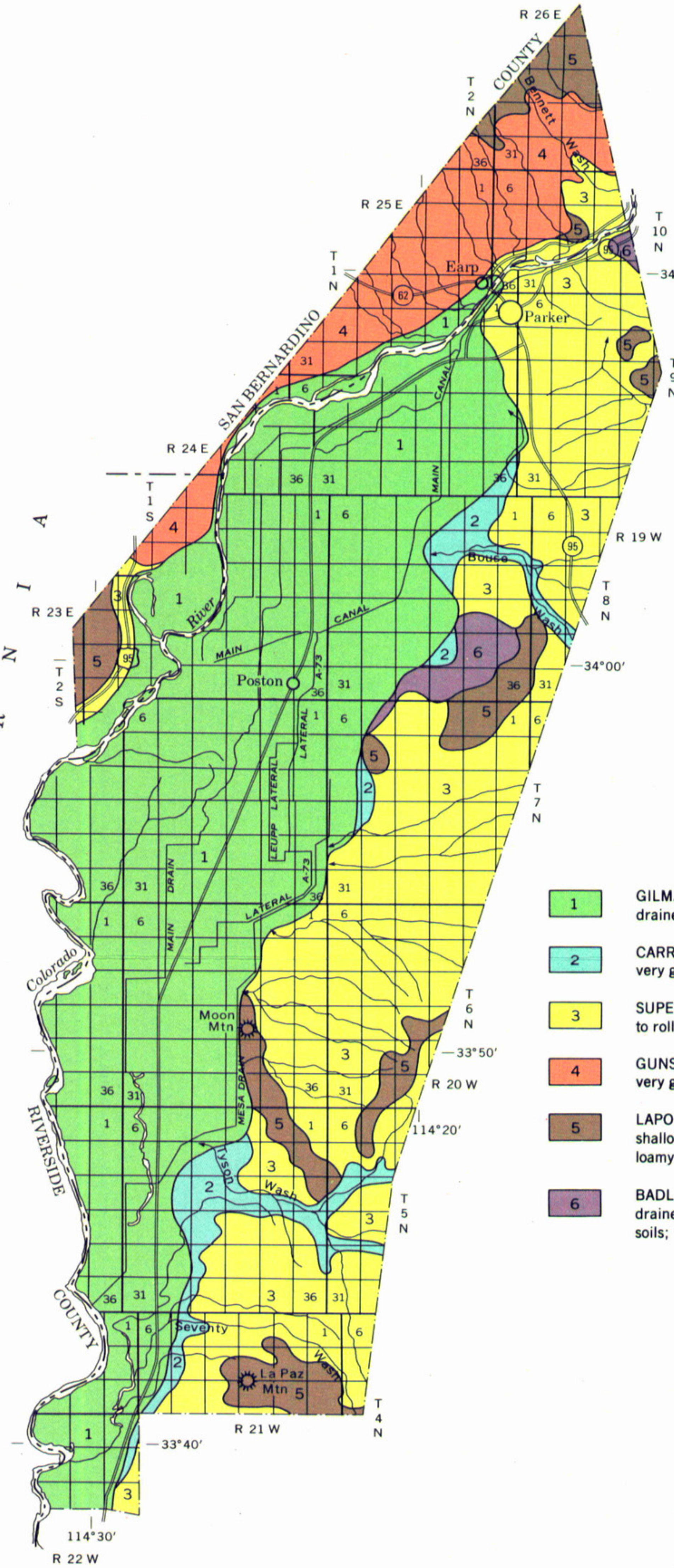


LEGEND*

1 GILMAN-GLENBAR-LAGUNITA: Deep, well drained and somewhat excessively drained, level to undulating, loamy and sandy soils; on flood plains

2 CARRIZO: Deep, excessively drained, nearly level to gently sloping, very gravelly and sandy soils; on flood plains

3 SUPERSTITION-ROSITAS: Deep, somewhat excessively drained, nearly level to rolling, sandy soils; on stream terraces and sand dunes

4 GUNSIGHT-CHUCKAWALLA: Deep, well drained, nearly level to very steep, very gravelly and extremely gravelly, loamy soils; on fan terraces and hillslopes

5 LAPOSA-ROCK OUTCROP-CHERIONI: Moderately deep, very shallow, and shallow, well drained, moderately steep to very steep, extremely gravelly, loamy soils, and Rock outcrop; mainly on hillslopes

6 BADLAND-TORRIORTHENTS-TORRIPSAMMENTS: Very shallow to deep, well drained and somewhat excessively drained, moderately steep to very steep soils; on hillslopes

COMPILED 1985

*Terms for texture refer to the dominant texture of the major part of the subsurface layers of the major soils

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF INTERIOR
BUREAU OF INDIAN AFFAIRS
ARIZONA AGRICULTURAL EXPERIMENT STATION
CALIFORNIA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

COLORADO RIVER INDIAN RESERVATION PARTS OF LA PAZ COUNTY, ARIZONA AND RIVERSIDE AND SAN BERNARDINO COUNTIES CALIFORNIA

SECTIONALIZED TOWNSHIP

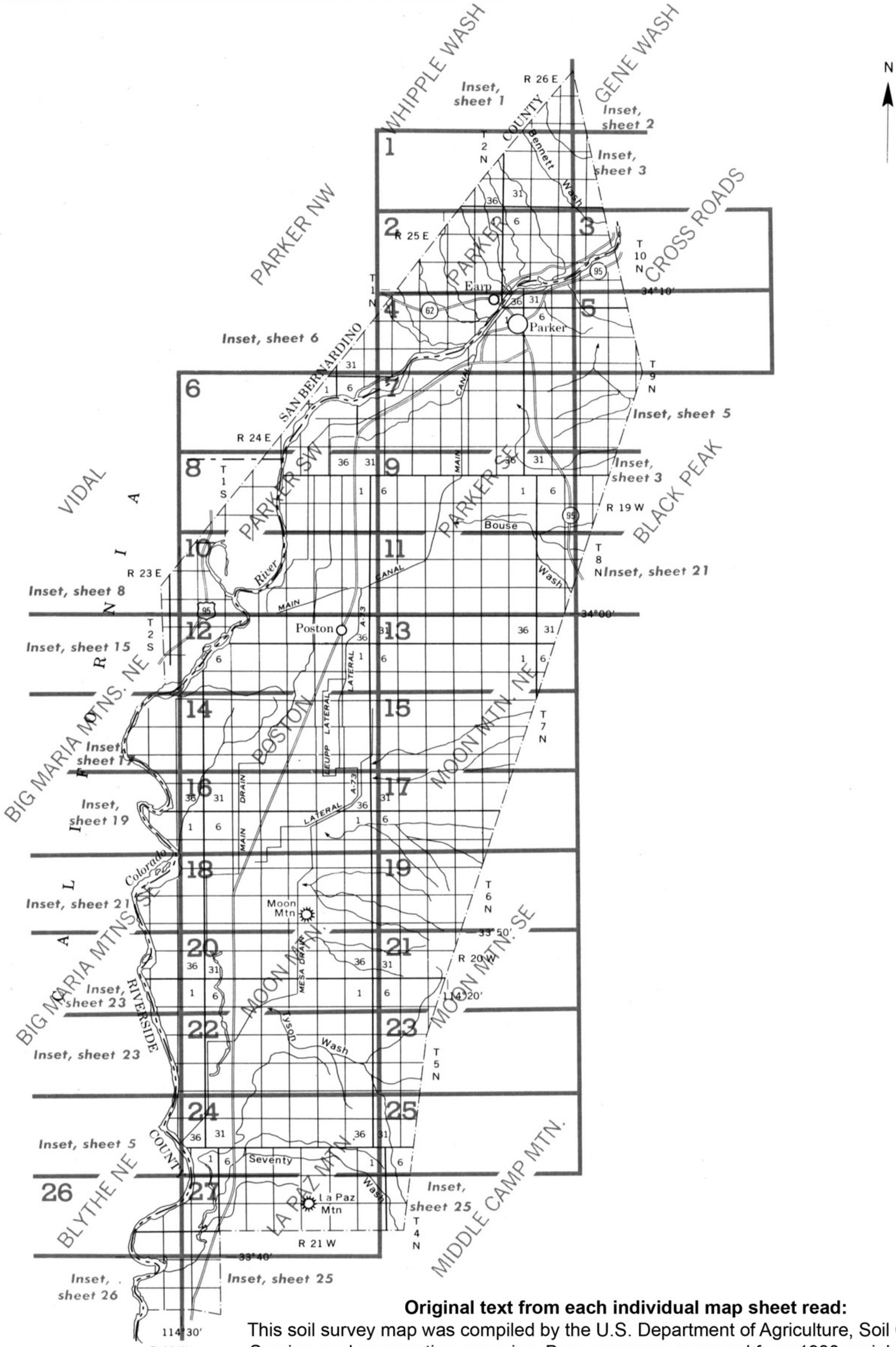
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

COLORADO RIVER INDIAN RESERVATION
PARTS OF LA PAZ COUNTY, ARIZONA
AND
RIVERSIDE AND SAN BERNARDINO COUNTIES
CALIFORNIA

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

SOIL LEGEND

SYMBOL	NAME
1	Agualt-Cibola sandy loams, 0 to 1 percent slopes
2	Agualt-Cibola sandy loams, strongly saline, 0 to 3 percent slopes
3	Antho loamy fine sand, 0 to 3 percent slopes
4	Badland-Torriorthents-Torripsamments complex, 10 to 60 percent slopes
5	Carrizo extremely gravelly coarse sand, 0 to 3 percent slopes
6	Cherioni-Rock outcrop complex, 25 to 70 percent slopes
7	Chuckawalla-Gunsight association, 1 to 45 percent slopes
8	Cibola-Agualt clay loams
9	Gadsden silty clay
10	Gadsden silty clay, strongly saline
11	Gilman fine sandy loam, 0 to 1 percent slopes
12	Gilman fine sandy loam, strongly saline, 0 to 3 percent slopes
13	Gilman clay loam, 0 to 1 percent slopes
14	Glenbar silt loam, 0 to 1 percent slopes
15	Glenbar silt loam, strongly saline, 0 to 3 percent slopes
16	Gunsight very gravelly sandy loam, 15 to 60 percent slopes
17	Gunsight-Chuckawalla-Carrizo association, 1 to 45 percent slopes
18	Holtville-Kofa complex, 0 to 1 percent slopes
19	Holtville-Kofa complex, strongly saline, 0 to 3 percent slopes
20	Lagunita loamy sand, 0 to 1 percent slopes
21	Lagunita loamy sand, strongly saline, 0 to 5 percent slopes
22	Lagunita Variant loamy sand, 0 to 3 percent slopes
23	Laposa-Rock outcrop complex, 15 to 75 percent slopes
24	Meloland sandy loam
25	Meloland clay loam
26	Ripley fine sandy loam, 0 to 1 percent slopes
27	Ripley fine sandy loam, strongly saline, 0 to 3 percent slopes
28	Superstition gravelly loamy fine sand, 0 to 3 percent slopes
29	Superstition-Rositas association, 0 to 15 percent slopes
30	Vint sandy loam, 0 to 1 percent slopes
31	Vint sandy loam, strongly saline, 0 to 3 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 7, 24

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

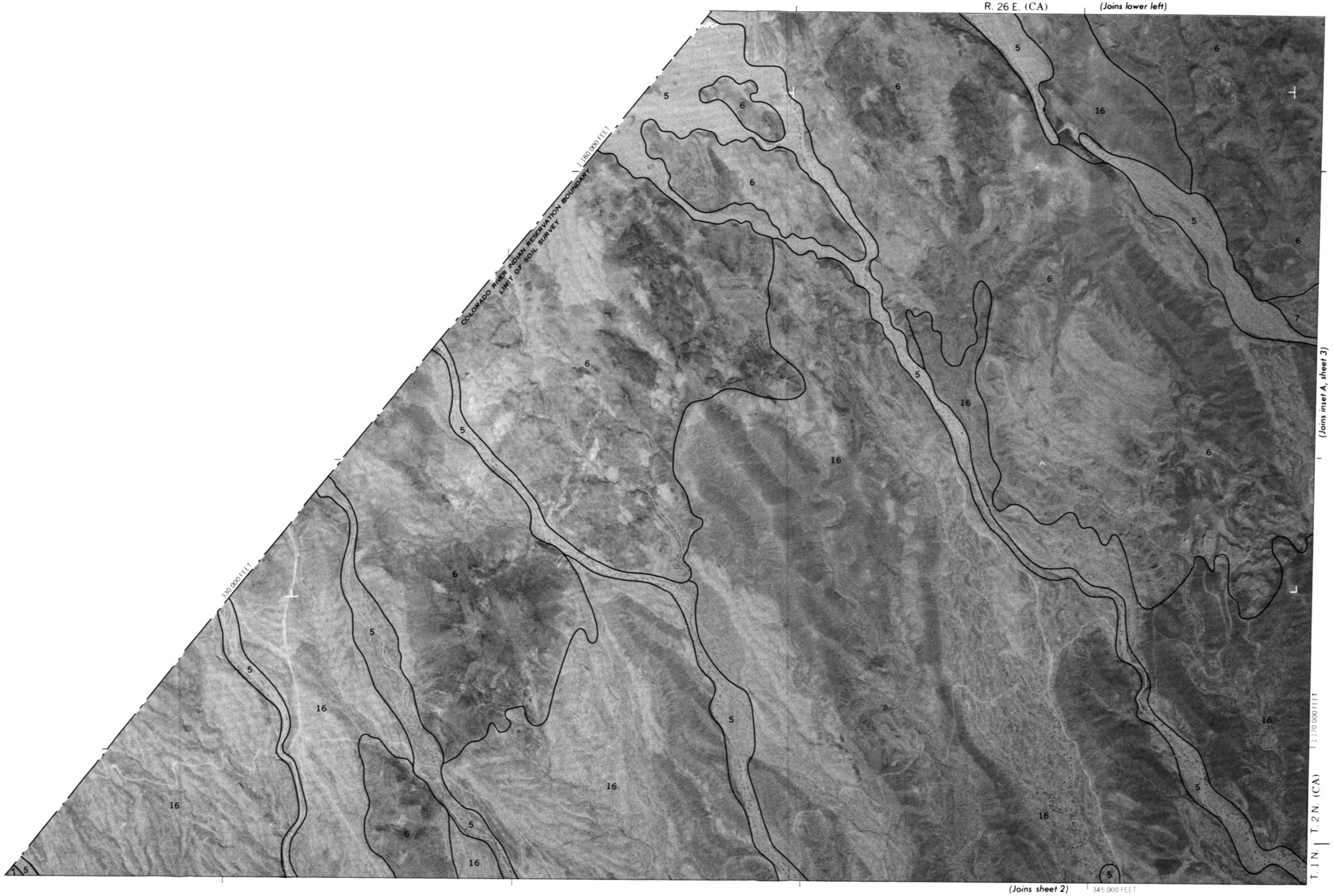
DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

INSET



1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

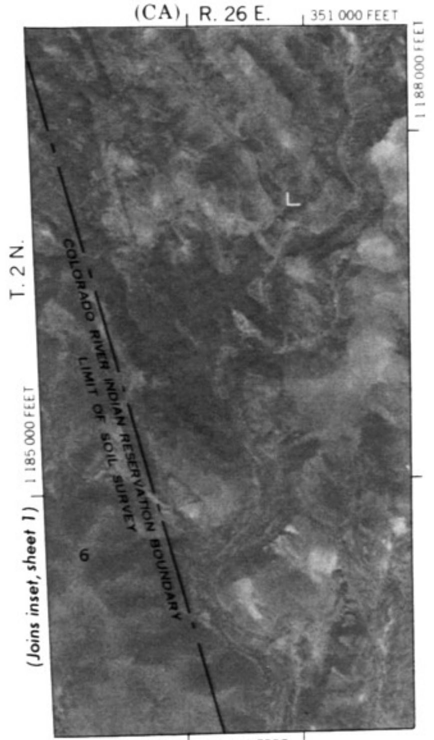
SCALE 1:20 000

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 2

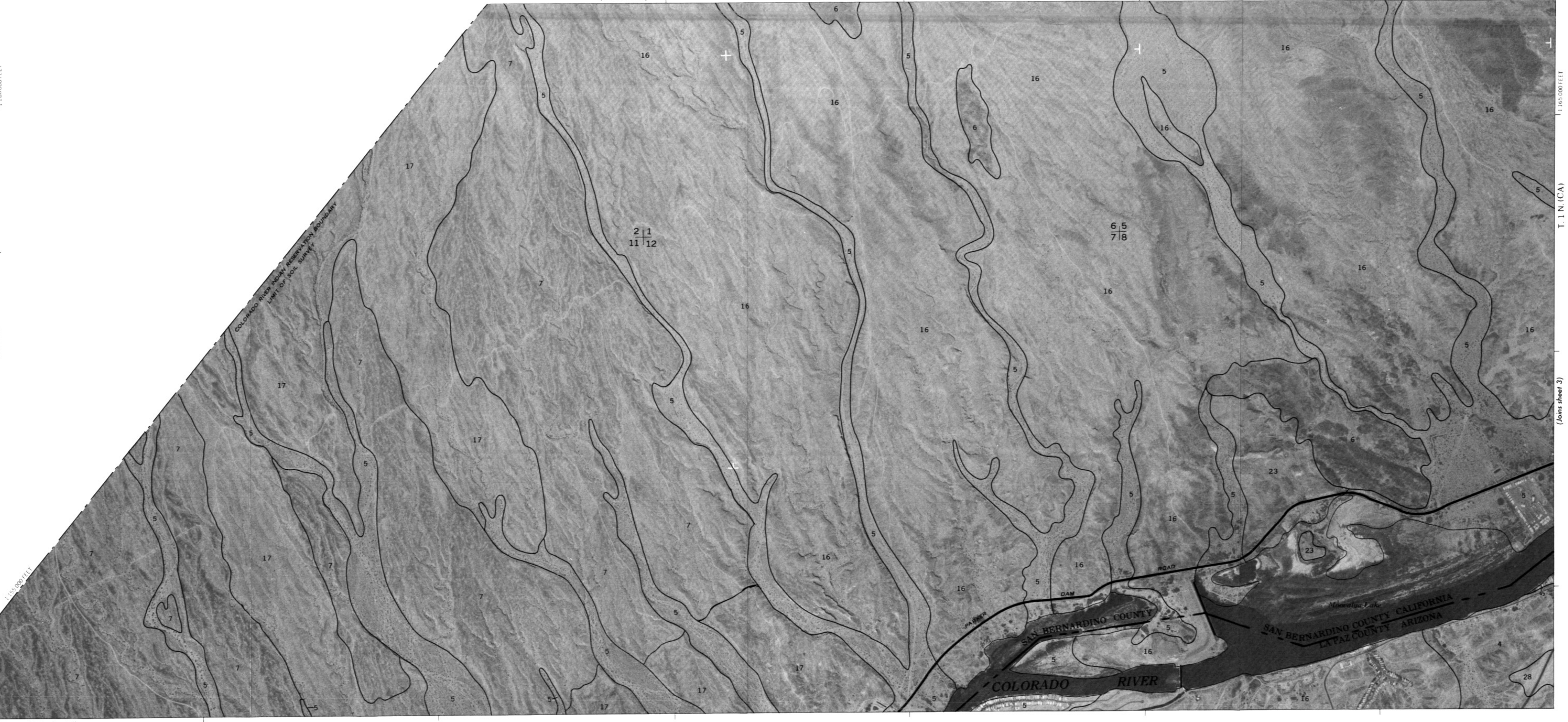
2

N

INSET



1000 AND 3000 FOOT GRID TICKS



1 3/4 1/2 1/4 0 1 MILE

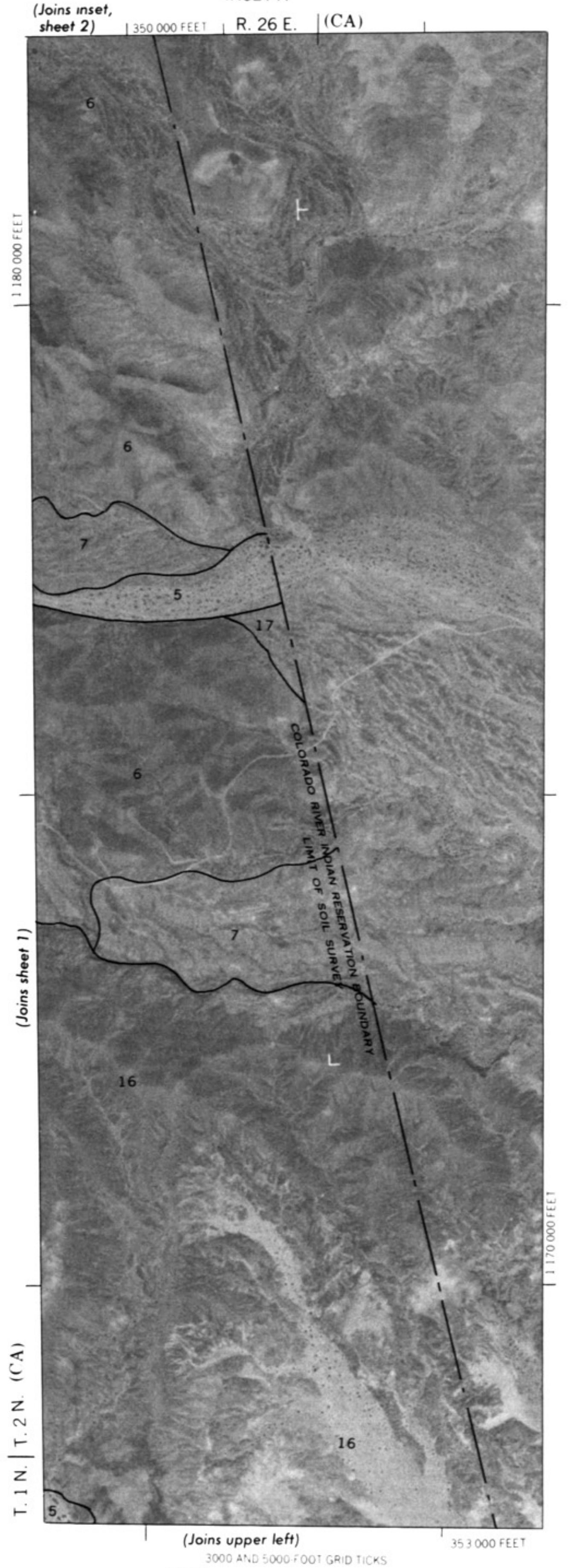
1 0.5 0 1 KILOMETER

SCALE 1:20 000

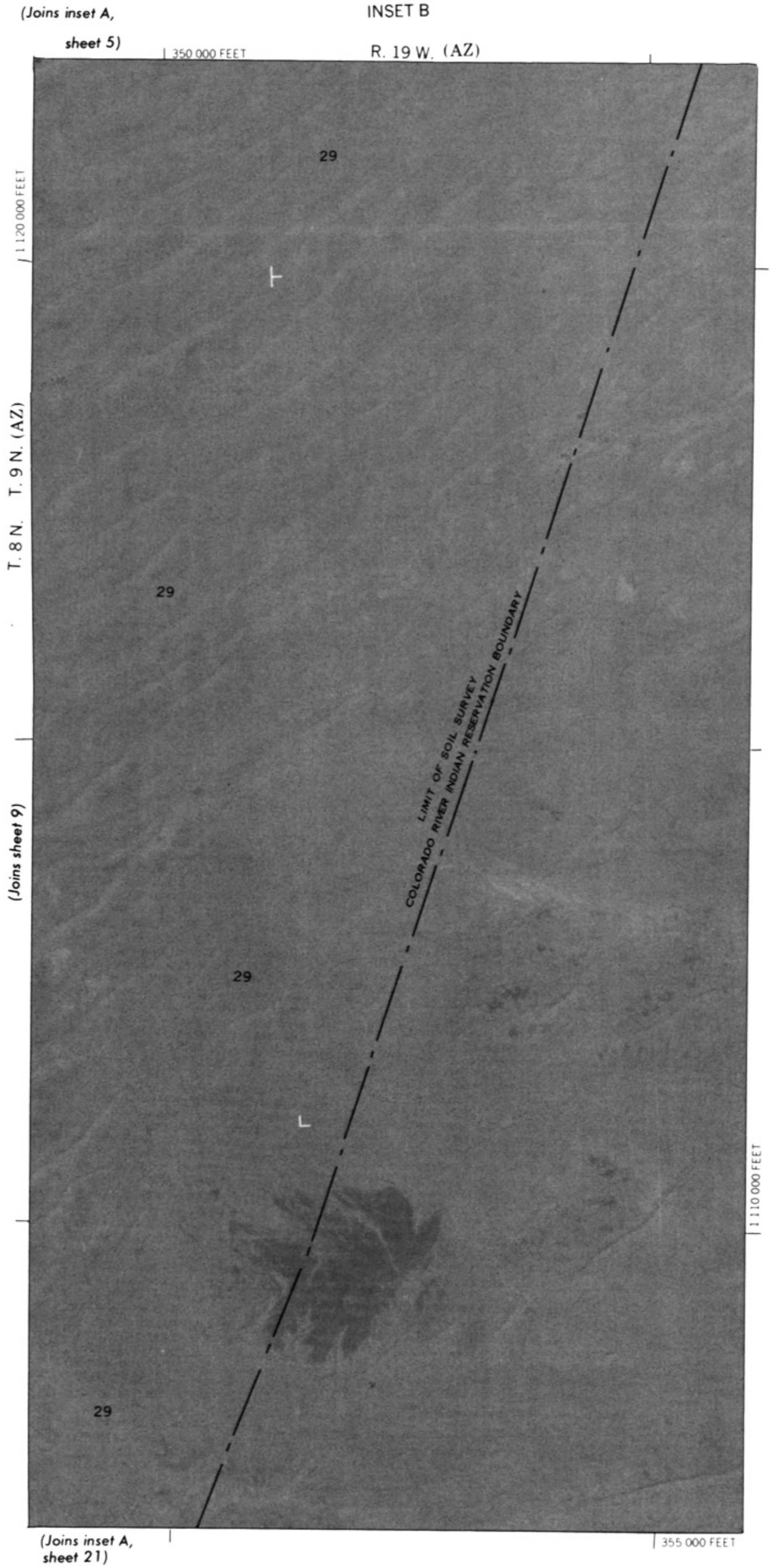
COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 3

N

INSET A



INSET B

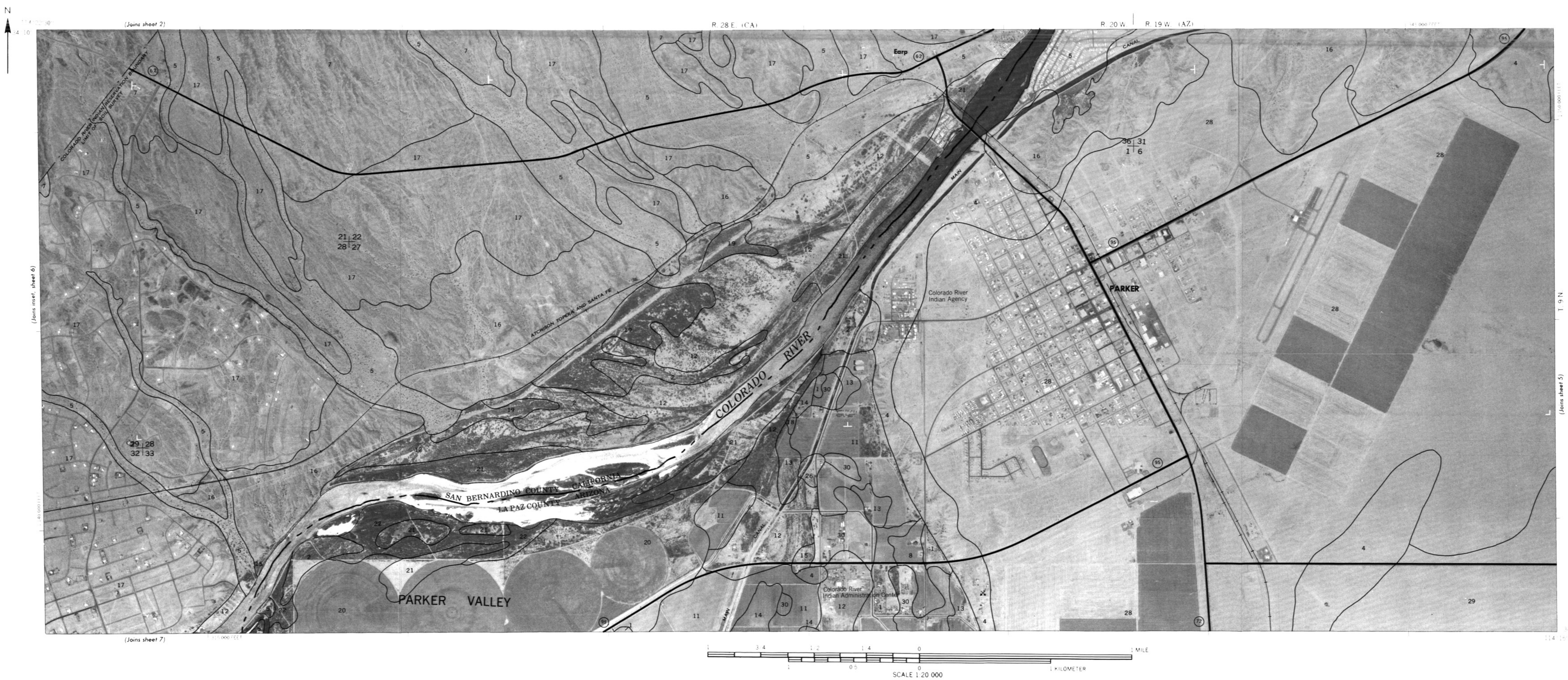


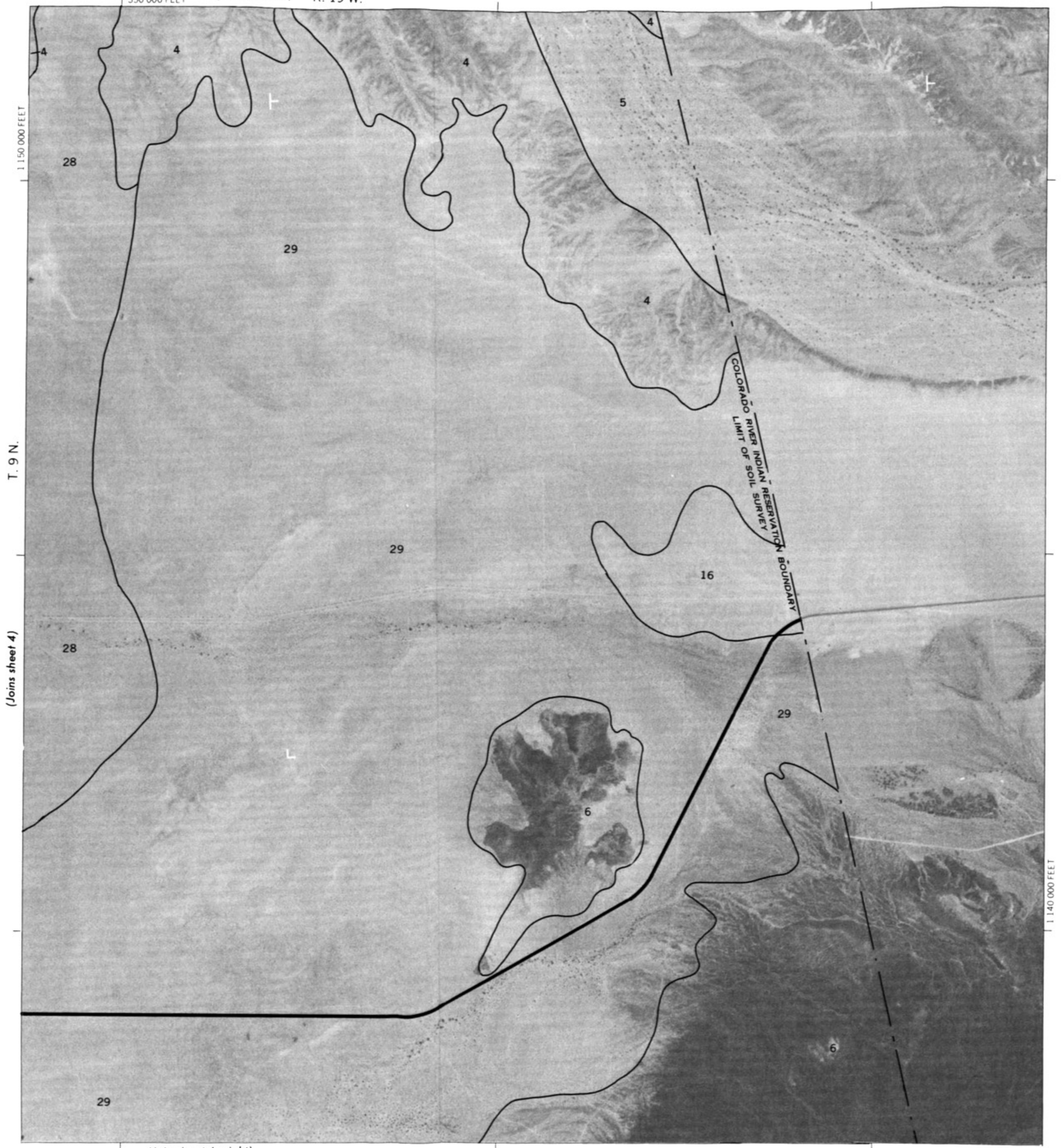
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

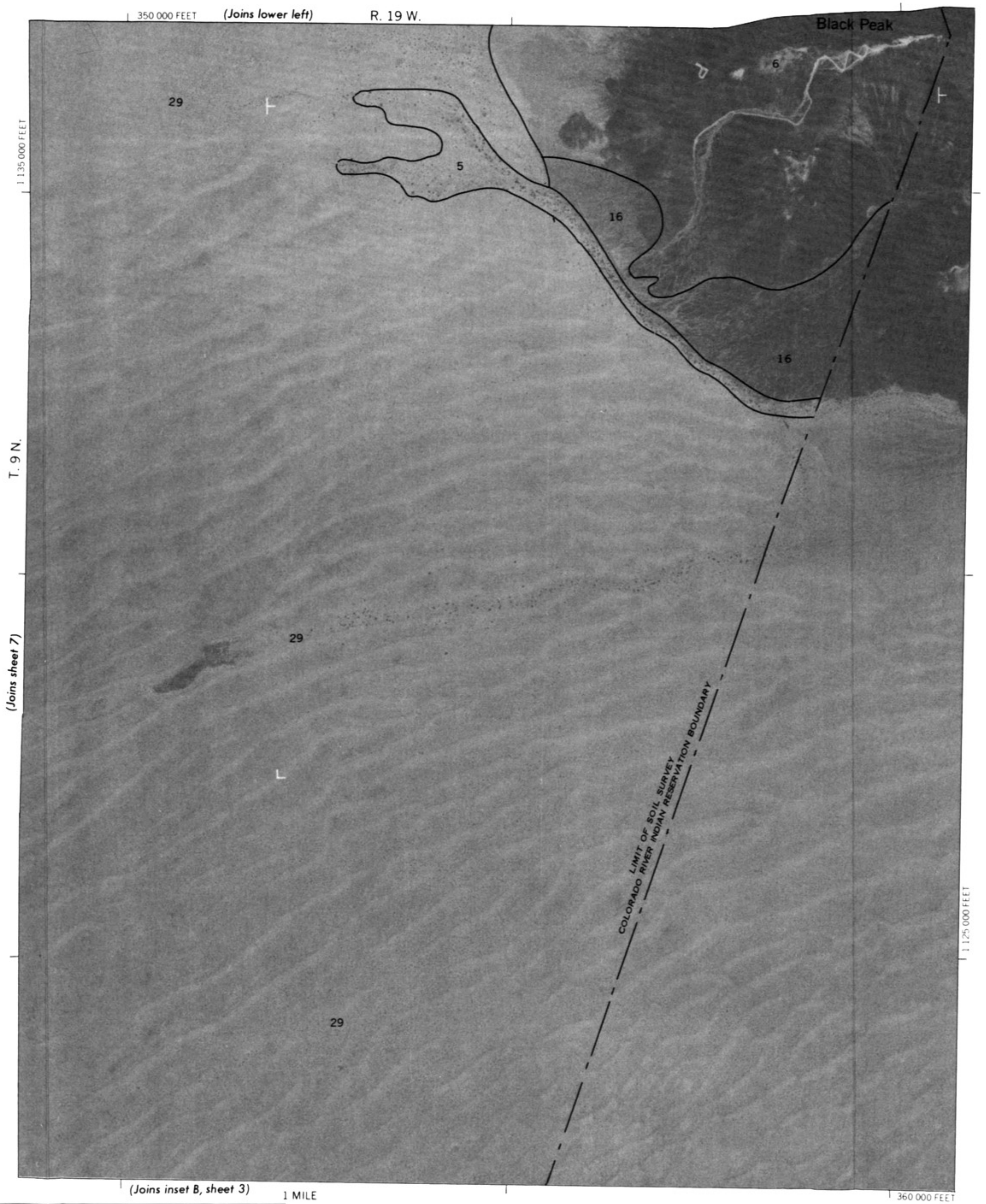
SCALE 1:20 000

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 4



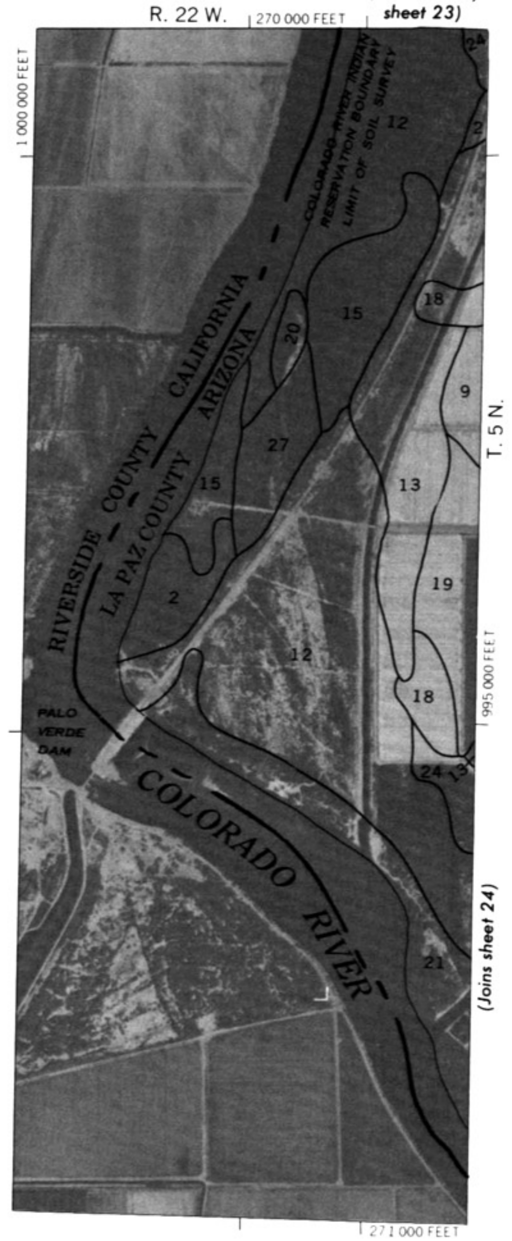


INSET A



N

INSET B



1000 AND 5000 FOOT GRID TICKS

1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:20 000

6

N

INSET

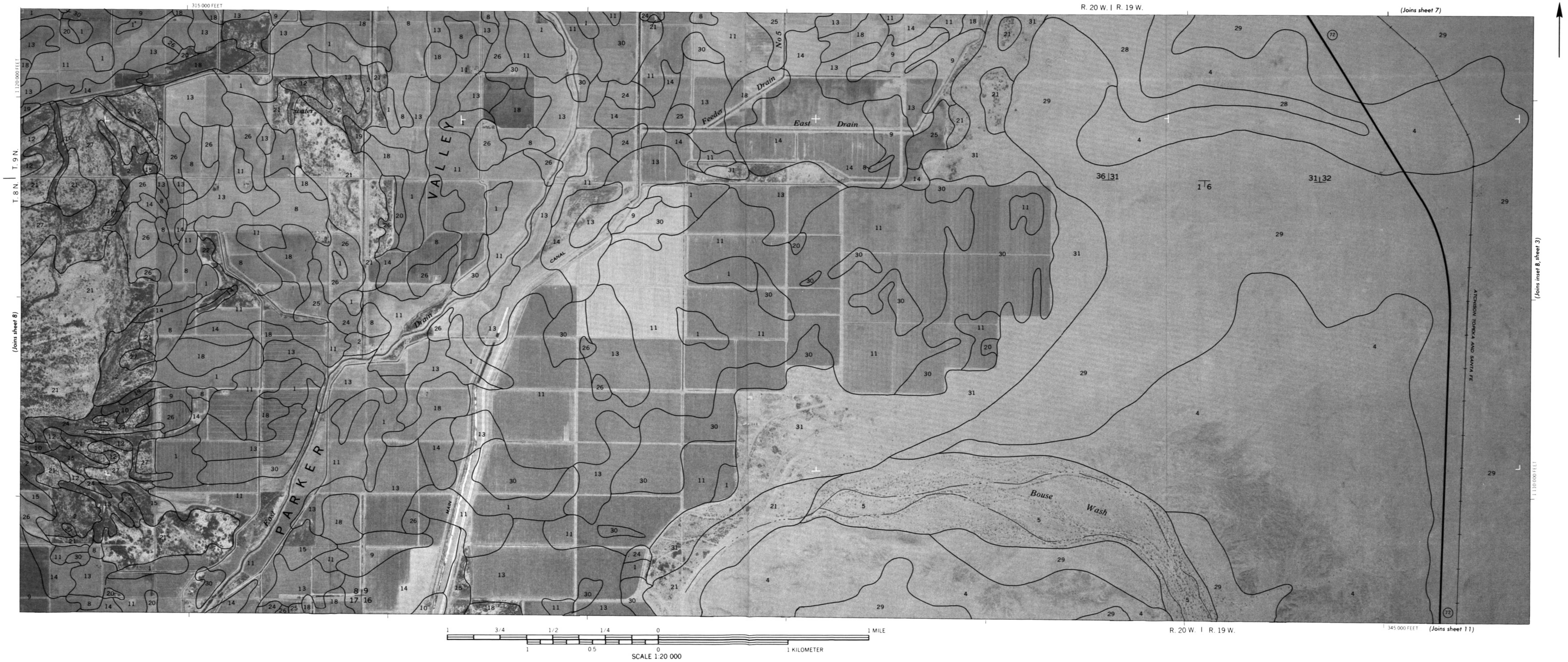
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:20 000

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 7


8
N
INSET
R. 23 E.
R. 24 E. (CA)
T. 2 S. (CA)
COLORADO RIVER INDIAN RESERVATION BOUNDARY
LIMIT OF SOIL SURVEY
(Joins sheet 10)
(Joins inset, sheet 15)
270 000 FEET
1 100 000 FEET
1 095 000 FEET
R. 24 E. (CA)
(Joins sheet 6)
R. 21 W.
R. 20 W. (AZ)
310 000 FEET
1 120 000 FEET
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
LA PAZ COUNTY
ARIZONA
COLORADO RIVER
T. 9 N.
T. 8 N.
(Joins sheet 9)
1 110 000 FEET
280 000 FEET
(Joins sheet 10)
95
1 MILE
1 KILOMETER
SCALE 1:20 000


9
N
315 000 FEET
1 120 000 FEET
R. 20 W. | R. 19 W.
(Joins sheet 7)
T. 9 N.
T. 8 N.
(Joins sheet 8)
(Joins inset B, sheet 3)
(Joins sheet 11)
345 000 FEET
1 110 000 FEET
PARKER VALLEY
East
Feeder Drain
No 5
East Drain
CANAL
Drain
MAIN
Bouse Wash
ATCHISON TOPEKA AND SANTA FE
72
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:20 000

N

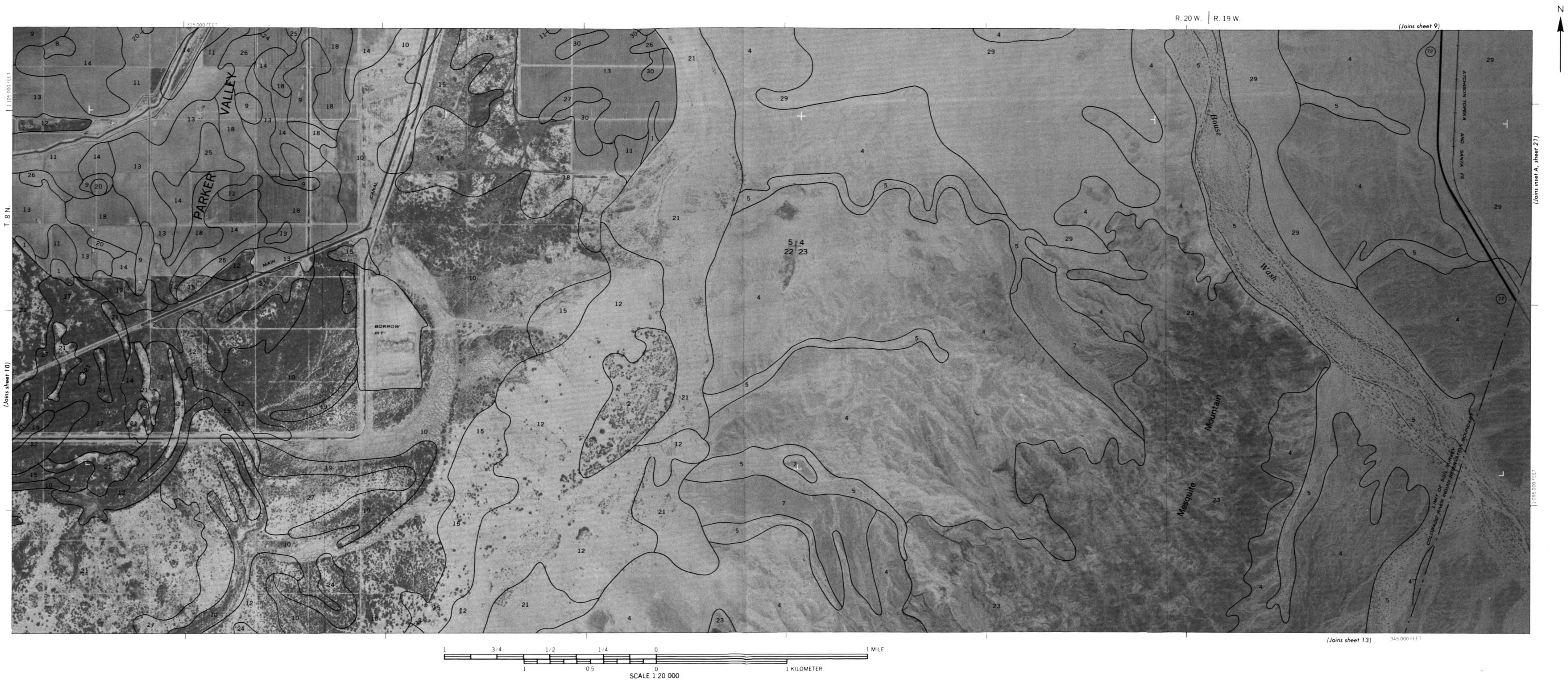
COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 10

1 3/4 1/2 1/4 0 1 MILE

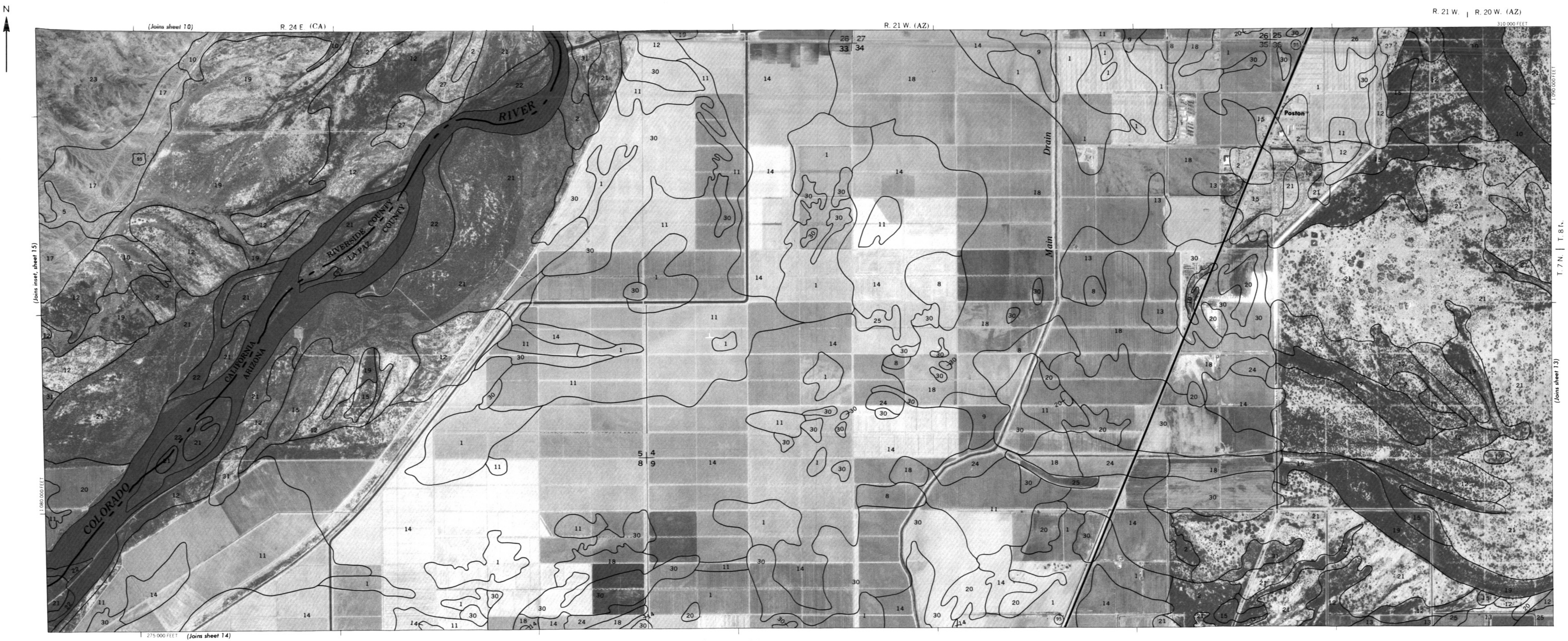
1 0.5 0 1 KILOMETER

SCALE 1:20 000

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 11



COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 12



1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

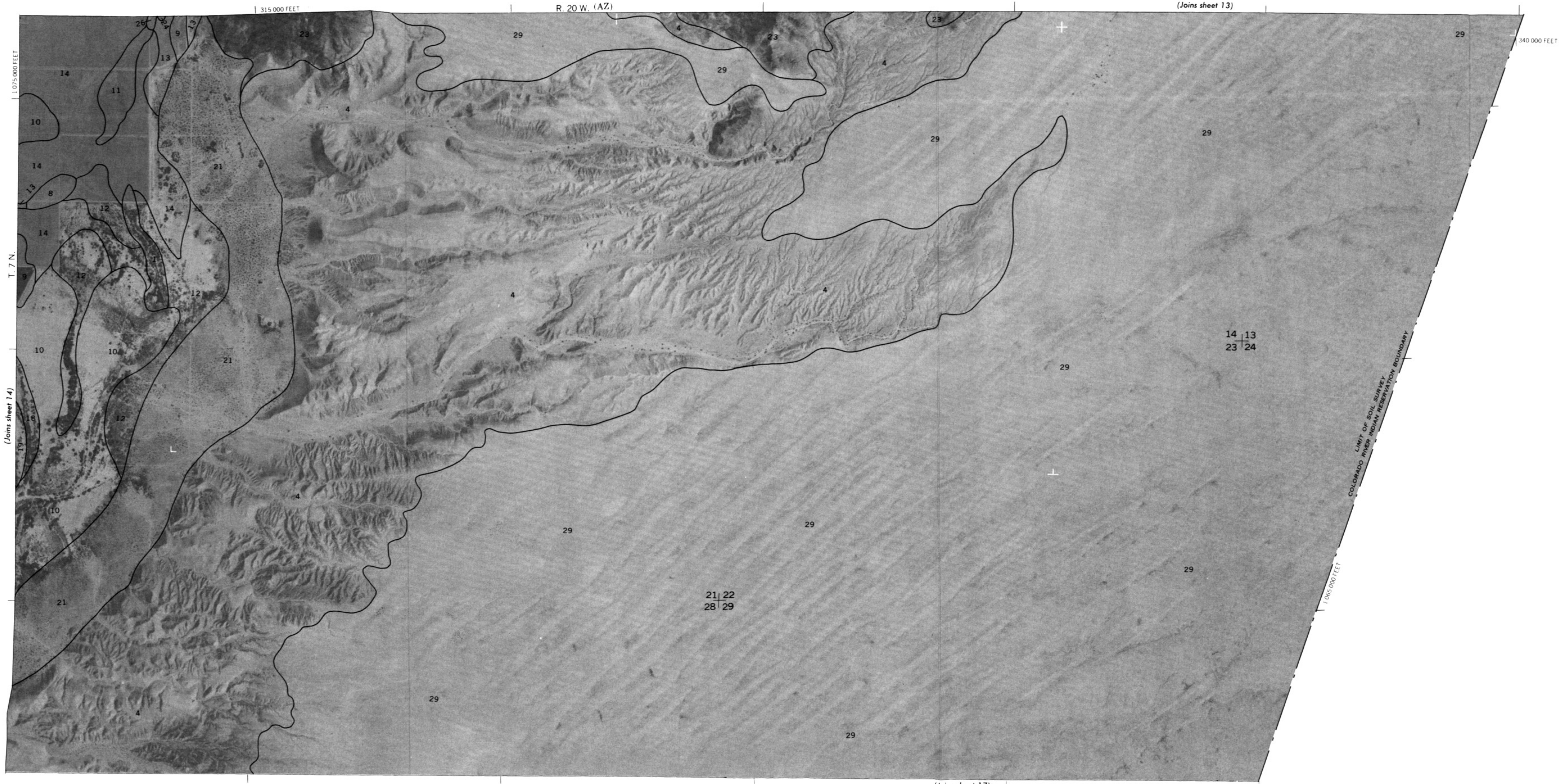
SCALE 1:20 000

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 13

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 14

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 15

15



1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:20 000

INSET

2000 AND 5000 FOOT GRID TICKS

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 16

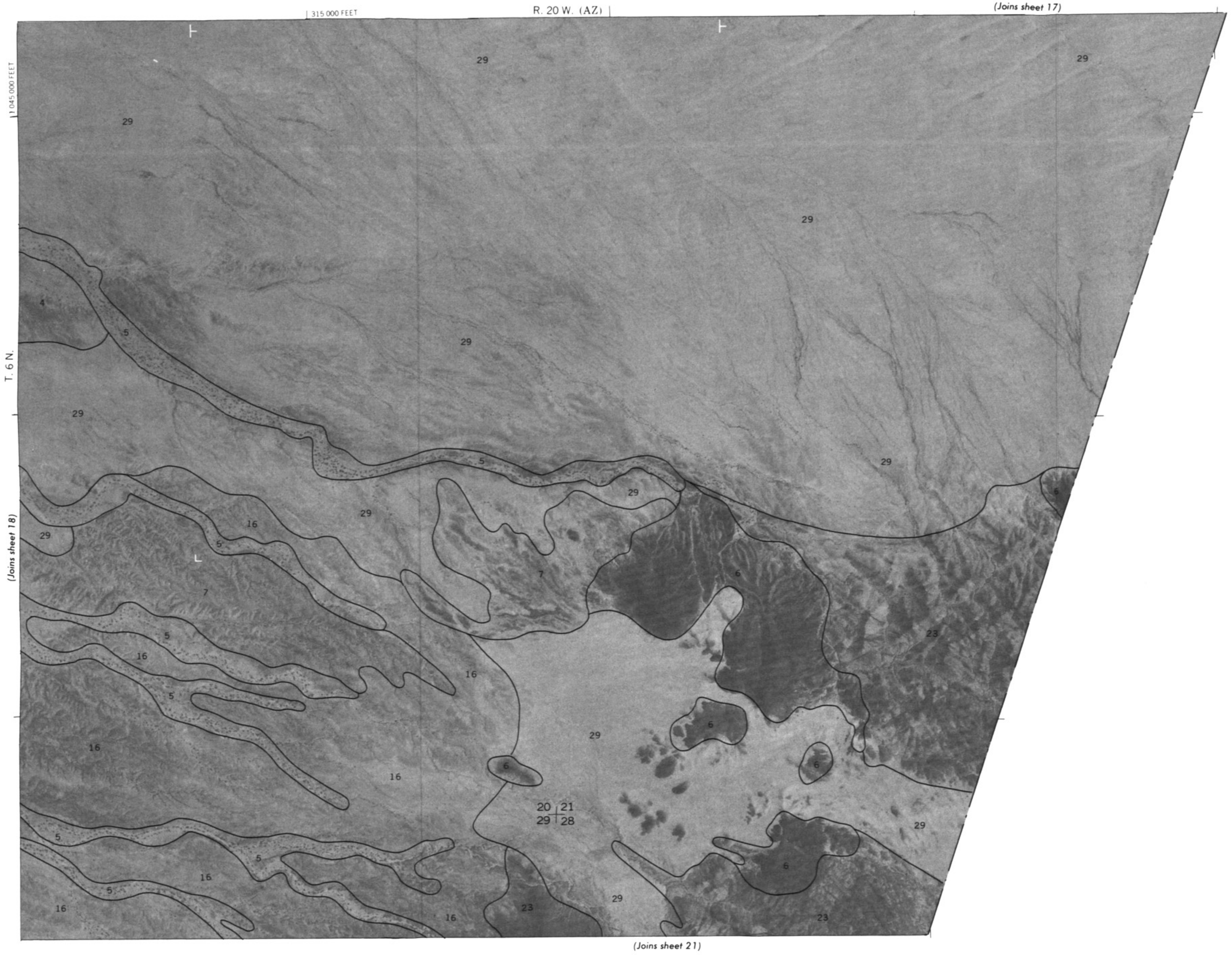
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:20 000


N
(Joins sheet 16)
R. 22 W.
R. 21 W.
310 000 FEET
1 045 000 FEET
(Joins inset B, sheet 21)
T. 6 N.
(Joins sheet 19)
PARKER VALLEY
Moon Mountain
DOME ROCK MOUNTAINS
1 035 000 FEET
275 000 FEET
(Joins sheet 20)
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:20 000

INSET



1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

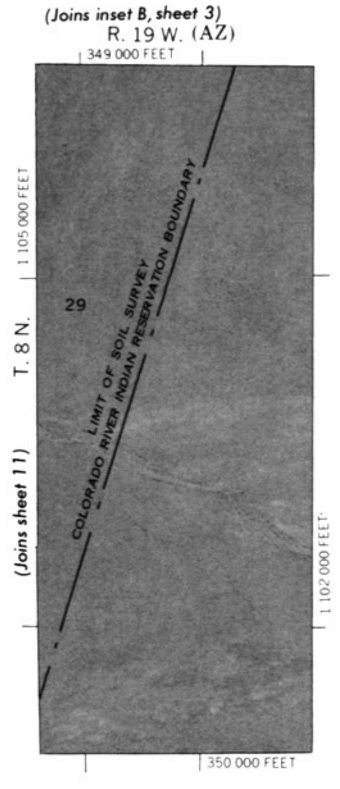
SCALE 1:20 000

1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:20 000

INSET A



1000 AND 3000-FOOT GRID TICKS

INSET B

1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:20 000

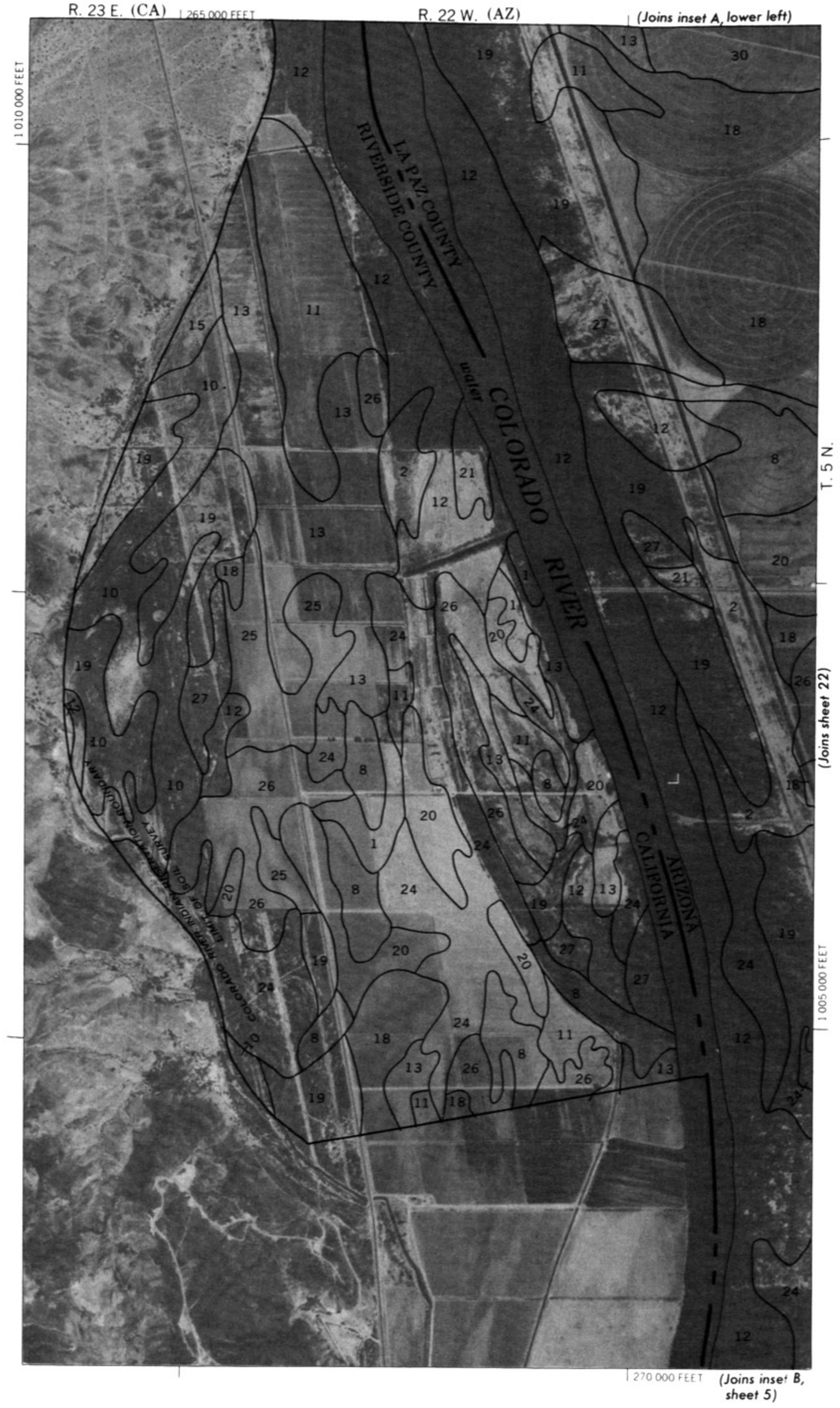
22


N
R. 22 W.
R. 21 W.
(Joins sheet 20)
R. 21 W.
310 000 FEET
1 015 000 FEET
(Joins inset 8, sheet 23)
(Joins sheet 23)
T. 5 N.
1 005 000 FEET
275 000 FEET
(Joins sheet 24)
VALLEY
PARKER
Mesa
Drain
Main
Tyson
Wash
DOME ROCK MOUNTAINS
95
10 11
15 14
17 16
20 21
23 24
26 25
1 MILE
1 KILOMETER
SCALE 1:20 000

N

INSET A

INSET B



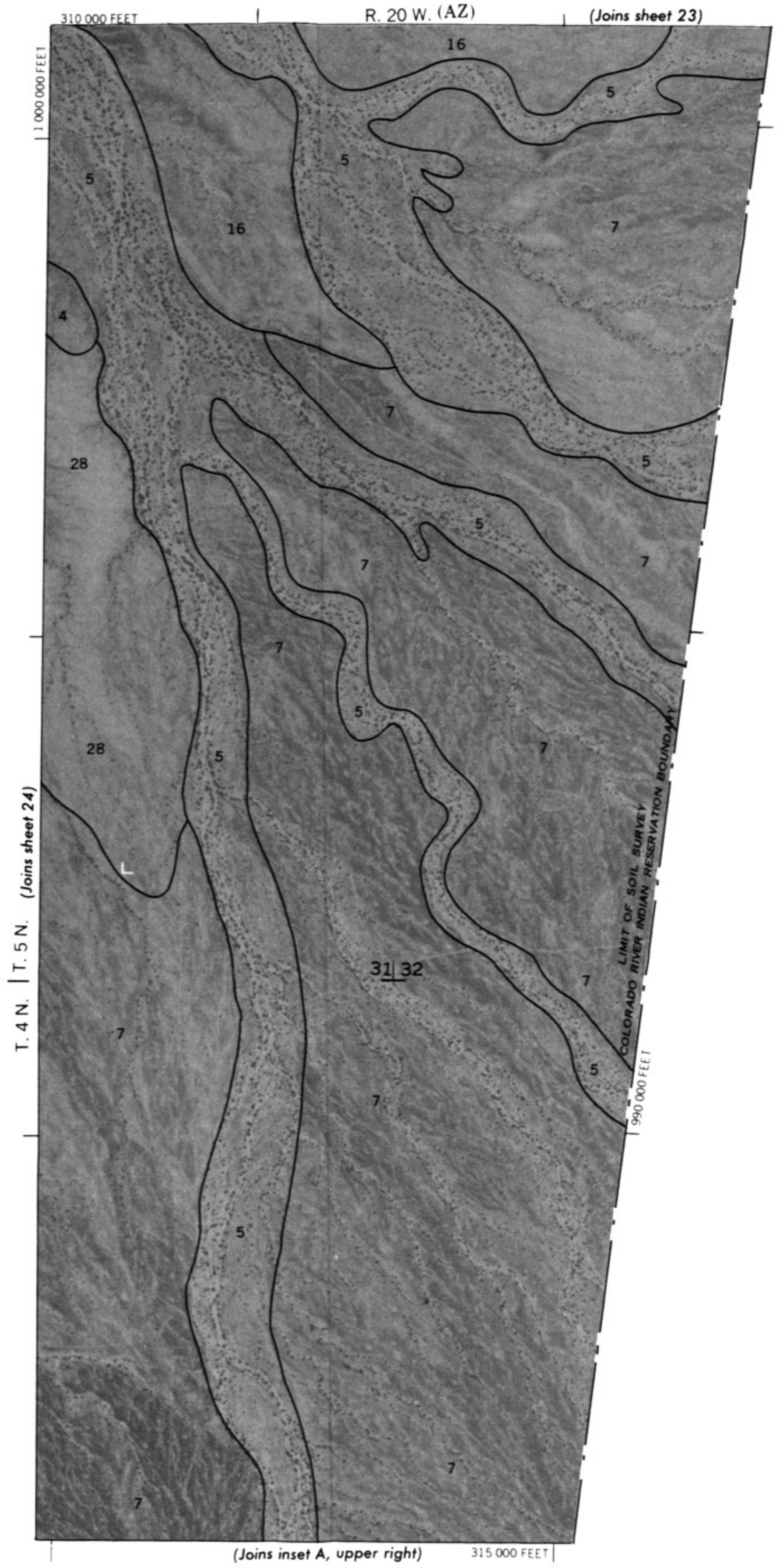
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

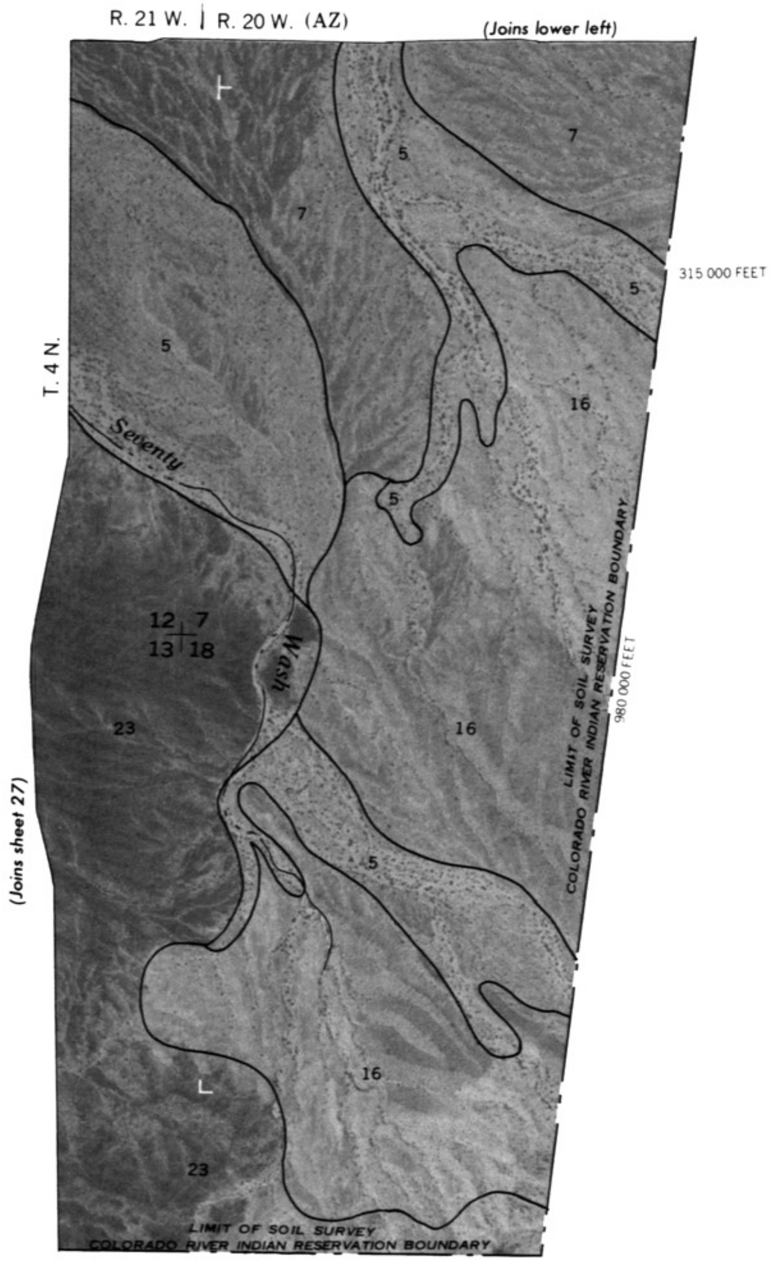
SCALE 1:20 000

COLORADO RIVER INDIAN RESERVATION, PARTS OF LA PAZ COUNTY, ARIZONA, AND RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA — SHEET NUMBER 24

N



INSET A



INSET B

1 3/4 1/2 1/4 0 1 MILE

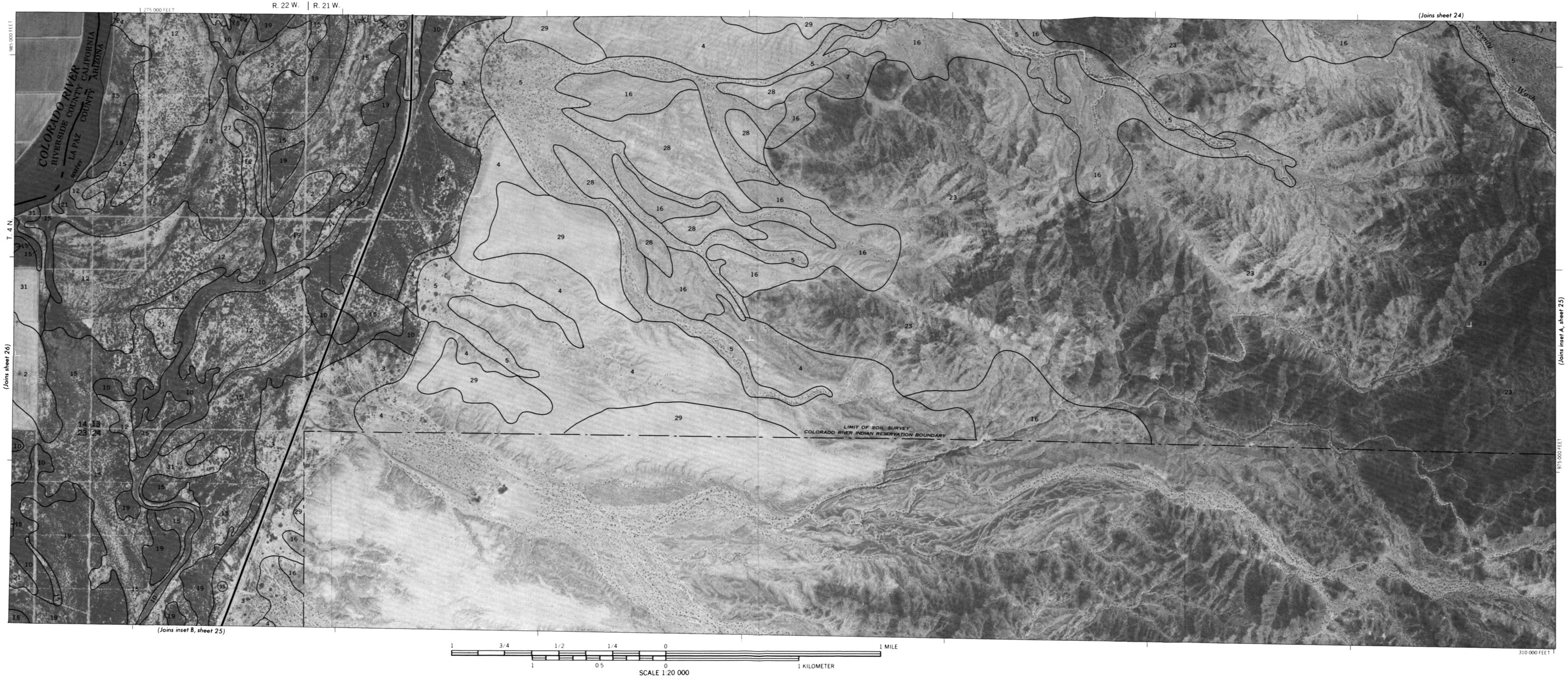
1 0.5 0 1 KILOMETER

SCALE 1:20 000

N


(Joins lower right)
R. 22 W. (AZ)
270 000 FEET
970 000 FEET
965 000 FEET
T. 4 N.
(Joins inset B, sheet 25)
RIVERSIDE COUNTY
LA PAZ COUNTY
CALIFORNIA
ARIZONA
water
COLORADO RIVER
LIMIT OF SOIL SURVEY
COLORADO RIVER INDIAN RESERVATION BOUNDARY
260 000 FEET
R. 23 E.
R. 24 E.
R. 22 W.


R. 23 E.
R. 24 E. (CA)
270 000 FEET
985 000 FEET
975 000 FEET
LIMIT OF SOIL SURVEY
RIVERSIDE COUNTY
LA PAZ COUNTY
CALIFORNIA
ARIZONA
COLORADO RIVER
water
T. 4 N. (AZ)
(Joins sheet 27)
255 000 FEET
(Joins inset, upper left)
R. 22 W. (AZ)
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:20 000


27
N
R. 22 W.
R. 21 W.
275 000 FEET
985 000 FEET
(Joins sheet 24)
(Joins sheet 26)
(Joins inset A, sheet 25)
(Joins inset B, sheet 25)
T. 4 N.
COLORADO RIVER
RIVERSIDE COUNTY
CALIFORNIA
LA PAZ COUNTY
ARIZONA
Sawtooth Wash
LIMIT OF SOIL SURVEY
COLORADO RIVER INDIAN RESERVATION BOUNDARY
975 000 FEET
310 000 FEET
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:20 000